United States Court of Appeals
for the
District of Columbia Circuit

TRANSCRIPT OF RECORD

In the

UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA.

October Term, 1944.

No. 8819.

Harry A. Noyes,
Appellant,

v.

Conway P. Coe, Commissioner of Patents,
Appellee.

UNITED STATES
COURT OF APPEALS FOR THE
DISTRICT OF COLUMBIA

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APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES
FOR THE DISTRICT OF COLUMBIA.

BRIEF FOR APPELLANT.

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HARRY A. NOYES,
appellant,
v.
CONWAY P. COE, Commissioner of Patents,
appellee.

Appeal from the District Court of the United States for the District of Columbia.

BRIEF FOR APPELLANT.

Jurisdictional Statement.

This case is brought to compel the issuance of a patent by the Commissioner of Patents under section 4915 of the Revised Statutes; U.S. Comp. Stat. 1916, § 9460, U.S.C. Title 35, § 63, as amended March 2, 1927 (44 St. L. 1355), and comes to this court on appeal from a judgment dismissing the complaint under Judicial Code, § 128, as amended; 28 U.S.C. § 225 (28 U.S.C.A. § 225).

The complaint is found in the record, p. 2 *et seq.*, and the answer, p. 11 *et seq.*

Statement of Case.

The appellant filed an application for a patent, and was allowed no claims. Upon appeal to the Board of Appeals (Examiner's Statement, A. p. 79 *et seq.*)[*] the examiner's position was sustained on two prior art patents, Taylor 2164362 and Zarotschenzeff 2,140,043 (Decision, Board of Appeals, A. p. 87 *et seq.*). The District Court, after hearing evidence, dismissed the complaint (A. p. 14). No evidence was offered in behalf of the defendant.

The invention relates to a method of freezing foodstuffs.

The Board of Appeals and the District Court had to deal with eleven claims. The applicant in this court, however, is dismissing from the case all claims but three, and is discussing herein only claims 25, 26 and 27, which follow:

> "Claim 25. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating alternately over a cooling means and the comestible until said comestible is substantially frozen a refrigerant solution of not over approximately sixty-five centipoises[†] viscosity at the temperature applied to carry out the freezing, which falls within the temperature range from approximately plus ten to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry

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[*] Since there is only one appendix in this case, the references to pages therein are designated as "A."

[†] Centipoise is a measure of resistance to flow (A. p. 23).

out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen back to the cooling means.

"Claim 26. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating alternately over a cooling means and over the comestible until said comestible is at least substantially frozen, a refrigerant solution of sodium chloride in water solution together with comestible extracts having a temperature as applied to carry out the freezing which falls within the temperature range from approximately plus ten to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen and back to the cooling means.

"Claim 27. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating alternately over a cooling means and the comestible until said comestible is substantially frozen, a refrigerant solution consisting of sugar and comestible constituents in water solution having a viscosity of not over approximately sixty-five centipoises at the temperature applied to carry out the freezing which falls within the temperature range from approximately plus ten degrees Fahrenheit to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen and back to the cooling means."

The salient features of the invention as expressed in the claims now in issue may be summarized as follows:

Claim 25 (1) The process of quick-freezing foods virtually without change cytologically or in chemical composition by

(2) spraying over the foods a solution of not over 65 centipoises viscosity at a temperature between 10° and 20° F. until the foods are substantially frozen.

(3) the temperature of the solution applied being not over approximately two degrees Fahrenheit above the temperature at which ice will separate from the solution

(4) the spray being so applied that it is rapidly and continuously replaced by a following solution and

(5) in great enough volume so that the temperature is not raised over 2° in the operating cycle from cooling means over the foods and back to the cooling means.

Claim 26 is similar to claim 25 except that the refrigerant is specified as sodium chloride in water solution with comestible extracts, and not restricted as to viscosity.

Claim 27 is also similar to claim 25 with the exception of the specification that sugar and comestible extracts with water compose the solution, the viscosity being not over 65 centipoises at the temperature of application.

It is appellant's contention that the claims in issue define an invention not found in the prior art, in so far as the claims define the freezing of foods with a sprayed solution applied at a temperature less than 2° F. above its freezing point with the necessary concomitant conditions.

It was, we contend, the appellant's discovery that osmosis, the bane of the freezing art, could be utilized to perfect the product and that it was not a detriment. He takes advantage of the inevitable osmosis to secure a quality product, with less depletion than any in the prior art. He discovered that, if a solution were sprayed on comestibles at a comparatively high temperature, and at a temperature not over 2° higher than the temperature at which ice would separate, the liquid escaping from the foods would quickly dilute the solution at the interface and thus raise its freezing point, so that the foods would almost immediately be encased in a shell of ice, and that further osmosis would thus be made impossible. Thereafter the freezing would proceed quickly from outside to within and with such rapidity that large crystals are not formed. The prevention of undue osmosis, *i.e.,* depletion of the liquid content of the fruit or food, is obviously of the greatest importance and the discoverer of a process effecting such result is certainly entitled to letters patent if his disclosure points out a way to secure it. No such process is found in the prior art. Such a disclosure is found in the case at bar.

The prior art patents here involved to Taylor and Zarotschenzeff do not disclose any process or method even remotely near the invention above described. No other worker in the field has even hinted at the approach found by Noyes. It is startlingly new. It merits protection. It has the great virtue of simplicity and the merit of practicability. It should be held patentable.

Attention should be directed to the fact that neither the examiner's statement nor the decision of the court deals with the theory of this application of a refrigerant which forms the invention and which is the subject-matter of this case on appeal (A. pp. 81-86, 13-14).

Statement of Points.

A. The invention of appellant set out in the claims involves a novel and useful theory, and his application teaches those skilled in the art the art of practising it.

B. The prior art does not disclose the appellant's theory or process.

C. The prior art is indefinite and vague and does not teach appellant's process.

D. All the lower tribunals based their conclusion on the false hypothesis that Taylor's solution could be sprayed. They assumed that the viscosity of Taylor's mix would lessen so rapidly that from 400 centipoises at 8° F. it would go to less than 65 centipoises at the appellant's range of 10°-20°. This theory, based on guesswork, is disproved in the record.

E. The appellant has stated a new theory and has taught its mechanical application. He is entitled to a patent.

Summary of Argument.

A.

The invention here involved is based on a new theory of operation. It freezes by using a solution less than 2° F. above that temperature at which ice will separate. Accordingly the dilution of the refrigerating solution by the juices of the foods raises the freezing point of the refrigerant, forms ice at the interface and an ice shell on the surface of the foods, preventing further depletion of the food by osmosis. The process gives a superior product not found hitherto in the art.

B.

The prior art does not anticipate. Two patents are cited. Taylor's patent is on an immersion process using a bath of extremely heavy viscous syrup at temperatures not above 5° F., and having freezing points not over 5° F. The foods are immersed in these solutions, which vary in percentages of sugars and character, but which are no less than 400 centipoises viscosity, as compared with appellant's viscosity range of less than 65 centipoises.

Zarotschenzeff also follows the theory of using the lowest possible temperature of a solution of sugar and fruit juices and freezes by spraying the foods therewith. His patent was the subject of work in the field and proved inoperable because of the extremely viscous nature of his solution. Zarotschenzeff expressly disclaims sodium chloride solutions which plaintiff successfully uses. Zarotschenzeff does not disclose the range of operation, viscosity nor volume of flow. His patent is no more than an invitation to experiment.

C.

The District Court erred in finding that the process of appellant was merely applying a refrigerant solution in the form of a spray over the foods to be frozen, said solution being in a temperature range of 10°-20° F. and of a viscosity not over 65 centipoises, with a rise of not over 2° F. in temperature in passing over the foods to be frozen, and in not noting that the solution must be applied at a temperature less than 2° above the temperature at which ice will form (Finding 3, A. p. 13). The court erred in its supposition that the solution of Taylor could be sprayed rather than used as a bath. The court erred in finding the composition, temperature, viscosity and rate of application of a refrigerant solution to be no more than the choice of mechanics skilled in the art, and erred in not finding that there was a crucial point or range of application in relation to the freezing point of the solution and the temperature of application.

The court erred in not finding that Taylor's patent was inoperable on foods not having one dimension at least as small as 1 inch, whereas appellant's process may be used on foods of any dimension.

The court erred in not finding Zarotschenzeff's patent to be indefinite and inaccurate, and a failure in operation, and insufficient to constitute an anticipation (A. pp. 13, 14).

D.

The Patent Office tribunals and the District Court were likewise in error in assuming without more that Taylor's solution having a viscosity of 400 centipoises at 8° F. would acquire a viscosity of 65 centipoises at a temperature between 10° and 20° F. This assumption is a fundamental error underlying all actions in the case denying a patent.

E.

The prior art does not satisfy the applicable principles of law to constitute anticipation.

Argument.

A.

The formation of an ice shell is new in the art.

Freezing is, of course, as old as winter. Artificial freezing is less than 100 years old, and its commercial application in quantity probably less than 50 years and perhaps even less than that.

Birdseye is popularly considered a pioneer in the so-called quick freezing art, his notion being that quick freezing prevented the formation of large ice crystals and hence did not break the cell walls of the foods. He used an air blast of temperature from 0° to —40° F. (A. 19).

Immersion of foods in freezing solutions and spraying foods with such solution was practised as will be later discussed herein.

The depletion of the foods by loss of the juices by evaporation or osmosis has been a very serious defect in the processes practised in the art. In air blast freezing such evaporation of course made the product different from what it would be in its natural state. Every one who has taken food from an artificial refrigerator has noticed how it has shrunk and dried.

In freezing by the use of sprays or immersion there has uniformly been a considerable depletion of the juices by osmotic action. Osmotic action may be defined as the mixing of two liquids separated by a permeable wall by passing through the wall, tending to equalize the conditions on the two sides of the partition (A. pp. 45-46). Thus if a sugar solution is placed on one side of a porous wall and water is placed on the other side, the liquids will mix and in course of time the solutions on each side will be of equal strength, more water going into the sugar solution and sugar going into the water (A. pp. 45, 46). So if a fruit is submerged in a sugar solution the water in the fruit will pass rapidly into the sugar since water has high mobility and low molecular weight, and the fruit consequently loses a part of its liquid content (A. p. 46). The passage of the sugar from the highly concentrated solution to interior of the fruit is much slower due to its lower mobility. This deterioration causes shrinkage in weight of as high as 14% in the fruits frozen by immersion (A. p. 36). The fruits immersed in the cold solutions have a higher fraction of water content than the sugar solution, and consequently the osmotic action comes into play rapidly as the temperature of the fruit is reduced.

The appellant, in his attempt to prevent the food losses by osmosis, abandoned the territory plowed out by his predecessors, the attempt to hasten the freezing by using solutions at extremely low temperatures, and went on an entirely different theory. He reasoned that, if a solution were used that had a comparatively high freezing point with increased mobility and that solution were sprayed on a food at a temperature just above its freezing point (more accurately the temperature at which ice will form), the liquid oozing out of the fruit would dilute the solution as it came in contact with it, and the diluted solution, having a higher freezing point, would form ice and thus a shell around the food. This ice casing or shell effectually prevents any further depletion by osmosis or damage by sodium chloride and the freezing of the food may then proceed without further depletion of the contents of the food contained within its skin or outside layers. By using this process, the outside crust of ice effectually preventing further depletion, the shrinking in weight is kept down to a minimum, for very juicy berries as low as 4% of shrinkage, and with fruits like plums with a skin there is practically no shrinkage (A. p. 36). Furthermore, the freezing of the interior is accelerated since ice conducts heat more rapidly than water (the heat conductivity of ice is .0057 and of water is .0013) (A. p. 64).

Furthermore, the application of the principle here elucidated makes it possible to freeze, with most satisfactory results, such foods as a 16-pound turkey, watermelons and the like (A. p. 57).

The foregoing discussion is intended to point out in simplicity the theory underlying the invention which is new in the art and is not suggested in the references.

However, the task of utilizing the principles of operation and making it a practical working method was not too easy.

It was not possible to use an immersion process. Immersion means just about that, the foods to be frozen are placed in a solution which may be circulated past them, and since the solution is at a low temperature, freezing of the foods will finally occur. However, the solutions were of such density in order to secure the low freezing points necessary, so it was thought in the prior art, that they were extremely sticky and viscous and evidently were operated on the theory that the mere use of low temperatures would cause a rapid freezing. The race was between osmosis and freezing, and osmosis kept enough ahead for such a period of time that depletion was substantial.

Although moisture from the foods diluted the solution, the freezing point of the solution was so much below the temperature at which the solution was applied that the freezing of the solution around the food was greatly delayed and the impairment in moisture content was considerable. There is in such immersion processes also a layer of solution around and close to the food which is substantially stationary as compared with the movement of the body of the solution and this inert layer becomes warmed by the heat of the food to a temperature much higher than the body of the solution. Thus in the prior art there were these two factors, the great difference between the freezing point of the solution and its temperature of application and the warming of the inert layer, both tending to prevent the formation of the ice layer necessary for success.

Immersion being impractical, and air blasting being out of the question, the sole recourse was to a spray method. But the spray method as previously practised prior to Noyes was open to the same objections as immersion, that is, the sprays were made to have the lowest possible freezing points and had been so viscous and heavy that they could not be formed into a spray. In fact, the spray was in streams of liquid of such weight and velocity that it disintegrated the food where it struck the foods and had no efficiency where it did not actually contact them (A. p. 43).

There was no suggestion in the spraying art that the temperatures should be adjusted so that the temperature of application was critically close above the freezing point, the essence of appellant's invention.

In fact, the art and persons skilled therein were all steeped in the tradition that lowest possible temperatures made for the ultimate success of any freezing operation.

Into this field came the appellant and made a new approach, which, viewed with hindsight, seems simple, is logical and proved successful.

He so proportioned his solution as to have a comparatively high freezing point at least 10°-20° F.; he combined with it a low viscosity, something less than 65 centipoises, and he operated with the solution only slightly above its freezing point. With these three different steps—and, be it emphasized again, *not one of them is disclosed, in the references*—he attained success.

We submit his process is novel and useful.

B.

The prior art does not anticipate.

The prior art patents do not disclose the appellant's method. They are vague, contradictory and inaccurate. They are not operable with success. They do not squarely anticipate but must be combined to effect a mosaic anticipation. Even the examiner and the Board of Appeals were misled by them.

Taylor, 2,164,362 (A. p. 103), discloses a heavy, sticky, syrupy mass which has a freezing point less than 5° F. It contains 57% invert sugar. The foods are immersed in the solution and it is circulated in such a manner as to maintain a temperature gain of not over 1° in its passing over the foods outside the inert stationary film. It is used in a temperature range of 0°-10° F. His preferred solutions are said not to exceed 1500 centipoises in viscosity at 5° F. (p. 2, col. 1, 1.14; A. p. 104), or another, not over 400 centipoises viscosity at 8° F. (p. 2, Col. 1, l. 42; A. p. 164). His range of viscosity is stated to be less than 1000 centipoises from 0°-10° F. The foods to be frozen must be less than ¾″ to 1″ in at least one dimension to be satisfactorily frozen.

In his typical example, Taylor uses a solution of 57% invert sugar with a freezing point of 0° F. and a viscosity of 400 centipoises at 8° F. The fruits are immersed therein at 5° F., a differential of 5° (Taylor, p. 2, col. 1, ll. 39-45; A. p. 104).

It is clear from Taylor's specification that his process is another example of the race between osmosis and freezing and he proceeds on the theory that the low temperature of his solution is the desirable feature. Taylor states that the temperature above which strawberries will not freeze is 13° F., a clear contradiction of the facts (see Exhibit 7, A. p. 98, and Noyes' testimony, A. p. 33).

Taylor points out possible experimentations available by removing dextrose and the like, but there is no intimation that the viscosity of his solution ever becomes as low or approaches the fluidity of the appellant's solution. It appears from the chart showing viscosity temperature relations (A. p. 95) and the tables of viscosity (A. pp. 65-66) that the Taylor solutions are all far too viscous to permit operation by the spray process as claimed by appellant.

Furthermore, there is no basis for the statement made by the Board of Appeals "It is not apparent that the Taylor patent mentions the immersion of the materials in his refrigerant or any other specific way of treating the same" (R. p. 90). In fact, Taylor states (p. 2, col. 1, ll. 37-40): "Whole suitably prepared fresh strawberries were immersed in an aqueous solution of invert sugar.'' Such a palpable error on the part of the Board of Appeals appears inexcusable.

There is, as we have stated, no allusion in Taylor to the three requisites of the appellant's process. Taylor's claims are not infringed by the appellant's process, inasmuch as every claim of Taylor's specifies a solution with a freezing point not higher than 5° F., and consequently Taylor's solution cannot be used by appellant to practise his method of freezing between 10° and 20° with a differential between the temperature of the solution and its freezing point of less than 2°. It is further clear that Taylor does not contemplate or mention the use of a spray, which is quite natural, as Taylor's sticky and viscous solution cannot be sprayed at all (A. pp. 28, 32).

The examiner and the Board of Appeals were evidently misled by the statements of Taylor as to viscosity. He gave an upper limit of viscosity of not over 1500 centipoises at 5° F. This is his upper limit (p. 2, col. 1, ll. 12-15; A. p. 104).

Taylor gave a lower limit of approximately 400 centipoises at 8° F. (p. 2, col. 1, ll. 39-43; A. p. 104).

In between these two extremes he describes solutions with a freezing point substantially below zero and with viscosities of less than 1000 centipoises at 0° F. to 10° F. (p. 1, col. 2, ll. 44-49; A. p. 103).

The Patent Office evidently thought the viscosity decreased so rapidly, going from 1500 at 5° F. to 400 at 8° F., that by the time it was warmed a few more degrees it would become less than 65 centipoises and hence would be sprayable at 20° F. But there is no warrant for that conclusion or inference. The facts in the record and the application, not disputed by the examiner and hence admitted for the purpose of this case, prove conclusively the contrary.

The solutions with these different viscosities and freezing points are obviously the result of different proportions and different mixtures varying in sugar content. This obvious conclusion escaped the lower tribunals entirely.

Taylor as a reference completely fails to teach the process which is the subject of the claims on appeal.

Zarotschenzeff, 2,140,043, is a patent on freezing with fruit juices and claims an ideal product, and a product frozen without losing "any of the natural properties of said product." This reference was relied on by the Patent Office to establish the use of a spray, and to show that fruit juices, water and sugars were capable of use in a solution for freezing such fruits. But Zarotschenzeff does not show any such process.

In his preferred example (p. 2, col. 1, l. 22; A. p. 102) Zarotschenzeff does not contemplate the use of any water, his only liquid being the juice from the comestibles. There is no method described for freezing anything but fruits which yield off juices of such character that they may be combined with sugar. Such vegetables and fruits which do not break into juice are not covered by the patent. This takes away such products as corn, peas, beans and similar foods. Of course meats are not within the concept of this patentee. Strawberries, cherries and pineapples and possibly some others are included. This very restriction immediately removes Zarotschenzeff as a reference against claim 26 (sodium chloride, water and fruit juices) without more. The patentee uses a solution that is so high in sugar content that it cannot be sprayed (A. p. 43). The best evidence that the patentee has a totally inoperable process is found in the evidence where it is shown that workers skilled in the art attempted to operate under the patentee's directions and made solutions which on application developed solid streams, not sprays, the heavy and sticky syrups forming a mass which completely destroyed the fruits where the material impinged on the subject-matter and left unfrozen the other fruit in the freezing receptacle (A. p. 43). And this unsuccessful attempt was under the direction of the patentee and his engineers (A. pp. 42, 43). The experience was unfortunate for the company concerned (A. p. 76).

That the patentee was inaccurate on his facts is further shown in his statement that it is ''advantageous . . . to use the natural juices of the product being frozen as the freezing agent . . .'' (p. 1, col. 1, l. 44; A. p. 101). It seems axiomatic that this instruction to the public is valueless since the freezing point of a fruit cannot be lower than the freezing point of the juice within it, which after all is the only part which ever freezes, the solids being unaffected by cold (A. p. 45).

The court will not be misled by the statement in the patent that there is produced a *liquid* ''coating over the product affecting homogeneous freezing throughout the fruit'' (p. 1, col. 1, l. 42; A. p. 101), which is not appellant's process, since appellant's real and substantial purpose is to produce a *solid* coating of ice almost immediately. Further, this patentee expressly disclaims the use of a brine solution, which, with his method, produces a result which can only be called inferior, as he says (p. 1, col. 1, ll. 22-51; A. p. 101).

This directly disqualifies Zarotschenzeff's disclosure as an anticipation of claim 26.

The patent here involved seems almost grotesque in its statement that the use of fruit juices as the freezing medium will prevent osmosis, viz., the travel of liquid from the fruit to the solution, although Zarotschenzeff says an equilibrium condition is caused by using the fruit of the juice as the refrigerating medium (p. 2, col. 1, ll. 45-59;

A. p. 101). This is an impossible situation, since the fruit and the juice of the fruit have the same freezing point (A. pp. 44, 45).

The only specific example given by Zarotschenzeff is inoperable as a spray. He specifies a mixture of fruit juices 50% and sugar 50%, the result being a mixture of such high viscosity that proper contacts with the foodstuffs cannot be obtained (A. p. 40). It is very sticky, heavy and only by use of extraordinary pumping power can it be forced through the nozzles (A. pp. 38, 39, 43). The use of a fruit juice containing the natural sugar of the fruit adds to the sugar in solution, and as Zarotschenzeff does not mention water in his preferred solution and claims of the patent (see p. 2, col. 1, ll. 20-26) and requires it to be so proportioned as to obtain the lowest possible temperature without freezing it *solid,* it is evident that he merely extends an invitation to experiment to the workers in the art. The sugar in the fruit juices adds so much sugar content that it is far above appellant's working limits (A. p. 41).

The use of other freezing point depressants, as alcohol, glycerine or other agents, is another vague, unhappy attempt to confuse or invitation to experiment (A. p. 45). There is no teaching of a process—merely a suggestion.

Osmotic action must occur if sugar is used in the solution, under the axiom that liquids will travel from the area of high concentration to the area of low concentration, and the patentee's statement that "no osmosis action will take place" (A. p. 102, Patent, col. 1, ll. 45-57) is unsound, false and most misleading (A. p. 44).

Therefore, appellant contends that Zarotschenzeff and Taylor both are misleading, vague, unsatisfactory in teaching the persons skilled in the art and totally failing in anticipative quality.

The subject-matter of the claims in the appeal at bar is novel and useful, and the indefinite prior art calling for experimentation does not anticipate.

The references are of the character held by this court not to constitute anticipation. "In order that a reference or a group of references may teach a process, the process must be deliberate and the means understood." *Kelly* v. *Coe,* 99 Fed. (2d) 435, 441.

C.

The errors of the lower tribunals are substantial.

The errors in the record call for a reversal.

The examiner erred in stating that the lower the temperature of the solution the more rapid the heat exchange "and that appellant uses refrigerants at such temperatures that the best compromise is attained between temperature and viscosity" (A. p. 84). The examiner here missed the point entirely.

The examiner erred (A. p. 86) in citing the example of Taylor (col. 1, p. 2; A. p. 164), saying that appellant uses the same solutions at the same temperature and the viscosity must be the same. 57% by weight of sugar with a freezing point of 0° F. cannot be in appellant's range since appellant in the claims here under review must apply his solution at or above 10° F. and within 2° of its freezing point. And every claim of Taylor specifies a solution having a freezing point not higher than 5° F. (A. pp. 104, 105).

The examiner erred most seriously in theorizing, in spite of the facts, that a viscosity of 400 at 8° F. would be much lower at a slightly higher temperature. The appellant has clearly shown and claimed that only a solution having a viscosity of less than 65 centipoises at 10° F. is suitable for his purpose, and the exhibits in the case establish that the viscosity of any solution having more than 50% sugar is not within appellant's range (A. p. 95; A. pp. 65, 66).

The examiner erred in not discussing and approving the novelty of applying a spray of a solution of not over 65 centipoises in viscosity at a temperature less than 2° F. above its freezing point.

The Board of Appeals erred in following the examiner's errors (A. pp. 87-91).

The Board of Appeals further erred in stating that the Taylor patent did not mention the immersion of materials (A. p. 90).

The Board of Appeals further erred in its statement that it would not be patentable to spray the solution of Taylor if desired (A. p. 92). The fact is that Taylor's solution not only is of too high viscosity to come within appellant's claims but furthermore it cannot be sprayed (A. pp. 28, 32; Tables, A. pp. 65, 66).

The District Court erred in finding, by implication at least, that the only teaching of appellant's application was a change in viscosity, composition and temperature and rate of application (A. pp. 13-14).

The District Court erred in its finding of fact that such differences as exist between Taylor and appellant are not invention. The error here seems to arise from his misconception of the real issue, the three steps we have emphasized herein.

Even a superficial study of the record in this case, we submit, will satisfy the most captious critic of the quality of invention here claimed, that there is much more to using a solution in freezing foods than merely dumping sugar and water together in some proportion or other and getting it down to its lowest temperature before "solidification of the refrigerating medium" (Zarotschenzeff, p. 2, col. 1, ll. 5-10; A. p. 102), or obtaining "the lowest possible temperature for the refrigerating medium without freezing it solid'' (p. 2, col. 1, l. 25; A. p. 102).

The prior art fails because of this very conception of lowest possible temperatures. As is amply demonstrated in the record, the engineers of a well-known and highly skilled engineering firm, with the participation of the inventor, Zarotschenzeff, were unable to get the process to work (A. pp. 26, 38, 41-43).

The courts have put it well in the statement that the best evidence that the defendant took nothing from the plaintiff is the evidence of bona fide trials over years and no satisfactory results reached. *Meigs* v. *Slaughter,* 58 U.S.P.Q. 535; 51 Fed. Supp. 794 (D.C. N.Y.), Coxe, J.; affirmed *per curiam,* 60 U.S.P.Q. 579, 140 Fed. (2d) 863.

And the engineers above mentioned were working in an attempt to secure satisfactory results for the licensees or owners of the Zarotschenzeff patent here in question. The methods of that patent followed in the ruts of the travelers before in that it was a search for the use of a refrigerant at the lowest possible temperature of the solution and that inventor failed to guard against high viscosity and accordingly never did succeed even in securing a sprayable compound, to say nothing of his failure to conceive that the secret of success was in a combination of three essentials.

The District Court further erred in finding that Taylor's solution could be used in the form of a spray rather than a bath (Finding 8, A. p. 13).

It is quite plain from the evidence that the Taylor solution, his least viscous one, is 400 centipoises at 8° F., and it is further undisputed that any solution of sugar and water is more than 65 centipoises in viscosity at 10° F. if it contains as much as 50% sugar or sucrose (see tables, A. pp. 65, 66, and temperature viscosity chart, A. p. 95). It is plain that both Taylor and Zarotschenzeff were bound to at least 50% sugar in their solutions. Taylor using a 57% sugar and water and Zarotschenzeff using a solution with a total content (including fruit sugars) of something over 54% and perhaps as high as 69% soluble solids (A. p. 41). And that such solutions are too viscous to come within the appealed claims and cannot be sprayed is not contradicted.

D.

The fundamental error as to viscosity of Taylor requires reversal.

The court evidently followed what appears to be the fundamental error of all the Patent Office tribunals, viz., that a solution of 400 centipoises at 8° F. would be so much less viscous at 10-20° F. that it would be less than 65 centipoises (A. pp. 86, 90), which is not supported by any evidence or any exhibit and is contrary to all the evidence. The tables mentioned, *which were not questioned by the examiner as to accuracy,* indicate that the greatest change in viscosity for a 10° change in temperature was not over 25, yet the Office stated "the viscosity would be much lower at a slightly higher temperature" (A. pp. 86, 89, 90). What the Office should have said was that the viscosity would be slightly lower at a much higher temperature, which is the proved fact.

The court, in following what we submit the record shows is an impossible hypothesis, fell into the error of the Office tribunals.

The doctrine of this court has for many years been to accept statements of the applicant. The court has said: "No evidence was taken nor were affidavits called for in the Patent Office. The statement of appellant in his application must be accepted as true." *In re Harbeck,* 39 App. D.C. 559.

Such a rule appears reasonable, as the examiners are to be persons of scientific ability and competent to detect and criticize any errors of scientific fact or theory (Act of Feb. 14, 1903, 32 Stat. 825; sec. 482; U.S.C. Title 35, sec. 7).

No criticism of the facts is found in the record.

The testimony of the appellant was not contradicted and the chart which he produced (A. p. 95), taken with the tables of viscosity and temperature relationships of sugar solutions here involved (A. pp. 65, 66), is accurate and the result of his own research and study. These exhibits prove beyond peradventure that the solution of Taylor cannot be classed as being of a viscosity of 65 centipoises or less in the range of 10°-20° F. There is, we strenuously urge, no warrant for the findings of the Patent Office tribunals and the District Court that Taylor's solution could be sprayed in the appellant's process (A. p. 14). The uncontradicted evidence further establishes that the sprayed refrigerant must be of low viscosity, at least under 65 centipoises, to operate as defined in the claims in issue.

Taylor's solution has a freezing point not higher than 5° F. *This alone is enough to negative Taylor as a reference,* as no possible construction of the claims here, having a range of 10°-20° F. in operation, could cover a solution with a freezing point of less than 8° F. at the lowest. It is thus impossible for Taylor to take advantage of osmosis. The viscosity of Taylor's solution is also much higher than appellant's limit of 65 centipoises (A. pp. 32, 33).

Taylor cannot freeze any foods not having at least one dimension less than one inch (Taylor Patent, p. 2, col. 1, ll. 30-34; A. p. 104). There is no such limitation in appellant's process (A. p. 37).

The tribunals below were clearly in error in stating that Taylor's solution could be sprayed in appellant's process, and in finding that Taylor's patent is an anticipation.

E.

Anticipation is not established on controlling principles.

Appellant has found a new process which gives a "premium" result (A. p. 50). It is a new, practical operation, nowhere found in the prior art.

The prior art does not anticipate; Taylor is a different process entirely—an immersion process with a different and inferior result. Taylor's theory is different, his range of solutions is different, his temperatures and capabilities are different.

Zarotschenzeff also has no theory which anticipates the claims in issue. He utilizes the juice of the fruit with sugar. He does not point out (except for one inoperable suggestion) what proportions of sugars and juices may be used, nor what proportions of alcohol, glycerine or other freezing point depressants should be utilized; in fact, he states: "The amount of the material added to lower the freezing point will vary for different fruits and vegetables and therefore the amount . . . to be added to the refrigerating medium should be determined separately according to the specific product to be frozen" (Zarotschenzeff Patent, p. 2, col. 1, ll. 14-20; A. p. 102).

He mentions all types of sugars and sugar syrups (p. 1, col. 2, ll. 30-40, and p. 2, col. 2, ll. 45-50). He makes of his patent a catch-all for everything without disclosing how to use it, leaving the public to experiment. He mentions brushing, dipping and, by inference, immersion (p. 2, col. 2, ll. 32-35).

His process was inoperative, either by the efforts of an engineering firm hired to put his theories into practice or by his engineers (A. pp. 26, 41-43).

Zarotschenzeff is not the character of references this court requires to constitute anticipation. "In order that a reference or group of references may teach a process, the process must be deliberate and the means understood" *Kelly* v. *Coe,* 99 Fed. (2d) 435, 441.

The above-cited case seems apposite to the case at bar. The invention was refused patent recognition in either case on the prior art, which was not successful. The theory of both inventors was new, the change was slight, the step was from failure to success. The references were combined by the Patent Office to form a mosaic anticipation. The prior inventors were unable to do what the applicant appellants did, but the Patent Office still refused a patent. We submit that, as in the case cited, the appellant here is entitled to relief.

Further authority for relief to the appellant is found in *Becket* v. *Coe.* In that case the court said: "Within previously claimed ranges, Becket has found more restricted ones which produce a different alloy from that known to prior inventors." *Becket* v. *Coe,* 98 Fed. (2d) 332, 336.

The appellant therefore urges that the prior art disclosures of Taylor and Zarotschenzeff are far from sufficient to instruct the public the proper and practical use of comestible juices with sugar and sodium chloride in spray freezing; that the kernel of the invention is not hinted at by either patent, and that the appellant has made a contribution to the art of freezing of inventive quality. The anticipations are inadequate to defeat him.

As Judge Learned Hand puts it: "No doctrine of the patent law is better established than that a prior patent or other publication to be an anticipation must bear within its four corners adequate directions for the practice of the patent invalidated. If the earlier disclosure offers no more than a starting point for further experiments, if its teaching will sometimes succeed and sometimes fail, if it does not inform the art without more how to practice the new invention, it has not correspondingly enriched the store of common knowledge, and it is not an anticipation" (citing many cases). *Dewey & Almy Chemical Co.* v. *Mimex,* 124 Fed. (2d) 986, 989.

We submit that the theory of appellant is new and ingenious, that the prior art does not teach any application of the forces and substances utilized by him to achieve his result and that his method is sound and practical, that his disclosure is ample to teach those skilled in the art how to practice his invention, that he has made an important step forward in the art concerned whereby he utilizes a natural law, known before only as a detriment, to the success of his operation.

We submit that the error of the tribunals below is conclusively demonstrated and that he is entitled to the claims here in issue.

We submit that appellant is entitled to a patent.

Respectfully submitted,
ARTHUR H. BROWN,
HERBERT A. BAKER,
53 State Street,
Boston, Mass.

APPENDIX TO BRIEF FOR APPELLANT

UNITED STATES
COURT OF APPEALS FOR THE
DISTRICT OF COLUMBIA

FILED NOV 1 1944

Joseph W. Stewart
CLERK

IN THE

United States Court of Appeals

DISTRICT OF COLUMBIA.

No. 8819

HARRY A. NOYES, *Appellant,*

v.

CONWAY P. COE, Commissioner of Patents, *Appellee.*

Appeal from the District Court of the United States for the District of Columbia.

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PRESS OF BYRON S. ADAMS, WASHINGTON, D. C.

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IN THE

United States Court of Appeals

DISTRICT OF COLUMBIA.

No. 8819.

HARRY A. NOYES, *Appellant,*

v.

CONWAY P. COE, Commissioner of Patents, *Appellee.*

Appeal from the District Court of the United States for the District of Columbia.

APPENDIX TO BRIEF FOR APPELLANT.

I.

PLEADINGS, DOCKET ENTRIES AND OTHER PAPERS DESIGNATED.

1 Filed Jul 7 1943

In the District Court of the United States for the District of Columbia.

Civil Action No. 20364.

Harry A. Noyes, 47 Maple Street, Newton, Massachusetts, *Plaintiff*,

vs.

Conway P. Coe, Commissioner of Patents, Washington, D. C., *Defendant*.

Bill of Complaint to Secure Issuance of Patent.

To the Honorable Judges of the District Court of the United States for the District of Columbia.

The Plaintiff, for his Bill of Complaint, alleges:

I.

The Plaintiff, Harry A. Noyes, is a citizen of the United States, residing at 47 Maple Street, Newton, in the County of Middlesex, and Commonwealth of Massachusetts, and brings this suit in his own right.

II.

The jurisdiction of this Court depends upon the Statutes of the United States relating to the grant and issuance of Letters Patent of the United States, and particularly upon that certain section thereof known as Sec. 4915 of the Revised Statutes; U. S. Comp. Stat. 1916, Sec. 9460; U. S. C., Title 35, Sec. 63, as amended March 2, 1927 (44 Stat. L. 1335).

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III.

The Defendant, Conway P. Coe, is the Commissioner of Patents of the United States, a resident of the State of Maryland, whose official residence as Commissioner of Patents is in the District of Columbia, and he is sued as Commissioner of Patents of the United States.

IV.

The Plaintiff, Harry A. Noyes, did invent certain new and useful improvements in the treatment of fruit, berries and other edible products by freezing with the aid of compatible solutions for which invention he filed an application for Letters Patent of the United States in the United States Patent Office on November 17, 1939, entitled "Freezing Comestibles with Compatible Solutions", which application was given the serial number 304,954; as shown by a certified copy of said application here in Court to be produced.

V.

The said application was filed in accordance and in full compliance with the laws of the United States and the Rules of Practice of the United States Patent Office.

VI.

The said application has been duly prosecuted in accordance and in full compliance with the laws of the United States and the Rules of Practice of the United States Patent Office governing such procedure.

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VII.

A patent on the aforesaid application has been refused by the Commissioner of Patents, Defendant herein.

VIII.

The said application has been passed on by the Primary Examiner who refused to allow any of the claims of said application, and the Primary Examiner finally rejected the following claims:

Claim 9. As a commercial frozen product whole and cut comestibles having a composition identical, as to individual or pieces of comestibles to the previous natural unfrozen state according to United States Food & Drug Administration standards of identity and carrying in addition on its surface frozen added sugar solution and comestible juices.

Claim 18. In a quick freezing spray process for freezing comestibles with virtually no loss in weight and change in structure by employing a water solution of comestible extractives and sugars as the freezing agent that has a viscosity of less than sixty-five centipoises at the temperature applied to carry out the freezing, the steps of applying and varying the amounts of the freezing solution applied as the freezing progresses so that the temperature of the freezing solution is not raised over two degrees Fahrenheit as it comes away from the comestibles at any stage in the freezing operation after the first minute and a half approximately.

Claim 19. In a quick freezing spray process for freezing comestibles with virtually no loss in weight and change in structure by employing a water solution of comestible extractives and sugars as the freezing agent that has a viscosity of less than sixty-five centipoises at the temperature applied to carry out the freezing, the steps of applying and varying the amounts of the freezing solution applied as the freezing progresses so that the temperature of the freezing solution is not raised over two degrees Fahrenheit as it comes away from the comestibles at any point in the freezing operation after approximately one and one half minutes in the freezing operations and further having the temperature rise of the freezing solution taper off as freezing progresses to give a rise in temperature of the freezing solution of one half degree or less during the last third of the time the solution contacts the comestibles in carrying out the freezing thereof.

4 Claim 23. The process of quick freezing comestibles cytologically and as individual units virtually un-

changed in chemical composition by the freezing operation comprising circulating a refrigerated sugar solution carrying comestible extracts and of not over approximately sixty-five centipoises viscosity to carry out the freezing of said comestibles, by directing said refrigerant solution alternately over the cooling means to maintain temperatures not lower than approximately plus ten degrees Fahrenheit and higher than approximately plus twenty degrees Fahrenheit and over the comestible until said comestible is substantially frozen, said refrigerant solution being applied to the comestible by spraying the solution over the comestible in such volume that the temperature of said refrigerant solution does not rise over three degrees Fahrenheit in circulating from the cooling means over the comestible being frozen back to the cooling means.

Claim 24. The process of quick freezing comestibles cellularly and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating a refrigerant sugar solution carrying comestible extracts and having a viscosity of not over approximately sixty-five centipoises, at the temperature applied to carry out the freezing, alternately over cooling means maintaining the temperature between plus ten and plus twenty degrees Fahrenheit approximately and over the comestible until said comestible is substantially frozen, said refrigerant solution is applied by raining it over the comestible and is so freeflowing at the temperature rained over said comestible that it is immediately replaced on the comestible surfaces by following solution and said refrigerant solution is applied in great enough volume to the comestible being frozen so that its temperature is not raised over three degrees Fahrenheit in its cycle from the cooling means over the comestible being frozen and back to the cooling means.

Claim 25. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating alternately over a cooling means and the comestible until said comestible is substantially frozen a refrigerant solution of not over approximately sixty-five centipoises viscosity at the temperature applied to carry out the freezing, which falls within the temperature range from approximately plus ten to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen back to the cooling means.

Claim 26. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating alternately over a cooling means and over the comestible until said comestible is at least substantially frozen, a refrigerant solution of sodium chloride in water solution together with comestible extracts having a temperature as applied to carry out the freezing which falls within the temperature range from approximately plus ten to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen and back to the cooling means.

Claim 27. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating alternately over a cooling means and the comestible until said comestible is substantially frozen, a refrigerant solution consisting of sugar and comestible constitutents in water solution having a viscosity of not over approximately sixty-five centipoises at the temperature applied to carry out the freezing which falls within the temperature range from approximately plus ten degrees Fahrenheit to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen and back to the cooling means.

6 Claim 28. In a quick freezing liquid contact spray process of freezing comestibles virtually without change in cellular and individual units as to chemical composition the step consisting of spraying the comestibles to carry out the freezing thereof with a refrigerant solution of sugar and comestible constituents having a viscosity of not over approximately sixty-five centipoises as applied to carry out the freezing at temperatures not lower than plus ten degrees Fahrenheit approximately.

Claim 29. In a quick freezing spray process of freezing comestibles virtually without cellular and individual unit changes in chemical composition the step consisting of spraying the comestible to carry out the freezing thereof with a refrigerant solution of sugar and comestible extracts that has a temperature as used falling in the range of from a low of approximattly plus ten degrees Fahrenheit to a high of approximately plus twenty degrees Fahrenheit and having a viscosity as employed to carry out the freezing of said comestible that falls in the range of from thirty to sixty-five centipoises approximately.

Claim 30. In a quick freezing liquid contact spray freezing process of freezing comestibles virtually without change in cellular and individual unit chemical composition by means of refrigerant solutions composed of sugar and comestible extracts the step consisting of maintaining the volume of refrigerant solution sprayed in carrying out the freezing of said comestible great enough so that there is always a large enough volume of refrigerant solution flowing over the comestible so that the temperature of said refrigerant solution is not raised over approximately two degrees Fahrenheit by heat extracted from the comestible being frozen.

Claim 31. As frozen products, frozen comestibles of the general morphological and cytological factors as illustrated by strawberries, cherries, cut fruits and shelled green peas that have been frozen both cellularly and as individual units without virtual change in chemical composition.

7

IX.

The Plaintiff appealed from the decision of the Primary Examiner to the Board of Appeals of the United States Patent Office, in accordance with the laws of the United States and the procedure of the United States Patent Office governing such appeals, and the Board of Appeals affirmed the rejection of the Primary Examiner in their decision dated October 13, 1942.

X.

The Plaintiff requested reconsideration of said decision of the Board of Appeals, who affirmed the rejection of the claims in their second decision dated December 8, 1942.

XI.

The Plaintiff then requested a further reconsideration for the correction of mistakes in the decision of the Board of Appeals dated December 8, 1942, and the Board of Appeals rendered a new decision dated January 11, 1943, in which a correction was made in their decision of December 8, 1942, and the previous rejection of claims was affirmed.

XII.

No appeal has been taken to the United States Court of Customs and Patent Appeals from said decisions of the Board of Appeals, but Plaintiff has elected and does elect to proceed under the provisions of said Revised Statute Sec. 4915, as amended, all as set forth in paragraph II. of this Bill of Complaint.

8

XIII.

The Commissioner of Patents by the Board of Appeals contends that the claims which are cited in the foregoing paragraph VIII. of this Bill of Complaint are not patentable in view of the references

Zarotschenzeff	No. 2,140,043, Dec. 13, 1938
Taylor	No. 2,164,362, July 4, 1938,

and the reasons given by the Primary Examiner in the Examiner's statement made in response to the Plaintiff's appeal.

XIV.

Plaintiff disagrees in this contention of the Commissioner of Patents and contends that his said claims set forth a novel and patentable invention over said references and that the reasons given by the Primary Examiner do not justify the rejection of said claims.

XV.

The Plaintiff avers that the said invention is new and useful, and was not known or used by others in this country before his invention thereof, and not patented or described in any printed publication in this or any foreign country before his invention thereof or more than two years prior to his said application, and not patented in any foreign country by him or his legal representatives on an application filed more than twelve months prior to said application for United States Letters Patent, and not abandoned.

9 Wherefore the Plaintiff prays:

1. That this Honorable Court adjudge that the Plaintiff, Harry A. Noyes, is entitled according to law to receive Letters Patent of the United States for the aforesaid invention as defined in claims 18, 19, and 23 to 31 inclusive hereinbefore recited.

2. That this Honorable Court decree that the Commissioner of Patents be authorized and directed to allow the aforesaid claims 18, 19, and 23 to 31 inclusive, or such of them and such other claims as upon hearing the Court may find patentable, and to issue to the Plaintiff United States Letters Patent containing said claims.

3. For such other and further relief in the premises as the nature of the case may require and as to this Honorable Court may seem meet.

4. And Plaintiff prays that a subpoena ad respondendum directed to the Honorable Conway P. Coe, as he is Commissioner of Patents of the United States, be issued out of and under the seal of this Honorable Court requiring him to appear and answer to this Bill of Complaint, and to do and receive whatsoever this Court may order in the premises.

HARRY A. NOYES
Plaintiff.

ARTHUR H. BROWN
53 State St., Boston, Massachusetts,
(Counsel for Plaintiff)

ARLON V. CUSHMAN
730 Fifteenth St., N.W.,
Washington, D. C.
(Associate Counsel for Plaintiff)

10 Commonwealth of Massachusetts, County of Suffolk, ss:

On this 30th day of June, 1943, personally appeared before me the above-named Harry A. Noyes, the Plaintiff named in the foregoing Bill of Complaint; and being duly sworn did depose and say that he has read the foregoing Bill of Complaint, and that the same is true to the best of his knowledge and belief.

MARION GILES
Notary Public.

* * * * * * * * * *

11 Filed Aug 4 1943

Answer to the Complaint.

To the Honorable the Justices of the District Court of the United States for the District of Columbia.

I, II, III. Defendant admits the allegations of paragraphs I, II and III.

IV. He admits that Harry A. Noyes, claiming to have invented certain alleged new and useful improvements in the treatment of fruit, berries and other edible products, filed in the Patent Office, on November 17, 1939, an application for patent thereon, to which application Serial No. 304,954 was given. He denies that the subject-matter claimed in said application constitutes a patentable invention.

V. VI, VII, VIII, IX, X, XI, XII, XIII. He admits the allegations of paragraphs V to XIII, inclusive.

12 XIV. He admits that plaintiff disagrees with defendant's refusal to issue to plaintiff a patent containing any of the claims of said application which are set out in paragraph VIII. He admits that plaintiff makes the contentions set out in paragraph XIV, but defendant denies such contentions. He states that the said claims are deemed to be unpatentable in view of the following prior patents and for the reasons given in the statement of the Examiner in answer to the appeal and the decisions of the Board of Appeals, rendered on October 13, 1942, December 8, 1942, and January 11, 1943, copies of which will be furnished at the trial:

Zarotschenzeff,	2,140,043,	December 13, 1938,
Taylor,	2,164,362,	July 4, 1939.

Profert of copies of these patents is hereby made.

XV. He admits that in said application plaintiff made averments corresponding to the allegations of paragraph XV, but he denies, for reasons aforesaid, that such allegations are sufficient to justify the issuance of a patent containing any of the claims set out in paragraph VIII of the Complaint.

W. W. COCHRAN
Solicitor, U. S. Patent Office,
Attorney for Defendant.

August 3, 1943.

I hereby certify that a copy of this Answer to the Complaint was mailed today, August 3, 1943, to the attorney for plaintiff, Mr. Arlon V. Cushman, 730 15th St., N. W., Washington, D. C.

W. W. COCHRAN
Solicitor.

* * * * * * * * * *

13 Filed Mar 22 1944

Findings of Fact.

1. This is an action under R. S. 4915 (U. S. C., title 35, sec. 63) in which it was sought to have the Court authorize the issuance of a patent to plaintiff containing claims 9, 18, 19, and 23 to 31, inclusive, of his application No. 304,954.

2. At the trial plaintiff withdrew the action as to claim 9.

3. The application here involved relates to the freezing of foods and discloses a process in which the foods are subjected to the action of a spray of liquid at a low temperature. The liquid used may be a sugar solution or a mixture of such a solution with fruit juices and the temperatures employed are said to lie preferably in a range from
14 10 to 20 degrees F. The application, however, suggests in one example the use of a temperature as low as 7°F. The application also states that it is desirable to maintain a viscosity of approximately 65 centipoises in the refrigerating liquid and that passage of the liquid over the food should be so regulated as to provide a rise of not more than two degrees in the temperature of the refrigerant.

4. The patent to Taylor No. 2,164,362 discloses a process of freezing foods in which the food is immersed in a bath of flowing refrigerant whose flow is so regulated as to provide a rise of temperature of less than 1°F. in its passage over the food. The refrigerating liquid may be a sugar solution and its viscosity may be approximately 400 centipoises.

5. The patent to Zarotschenzeff No. 2,140,043 discloses a process of freezing foods in which the refrigerating liquid passes over the foods in the form of a spray.

6. The exact composition, temperature, and viscosity of the refrigerating liquid and the rate at which such liquid is passed over the food to be frozen are matters of choice which involve nothing more than the ordinary skill of workers in this art.

7. Such differences as exist between the process disclosed in the Taylor patent and that set forth in the claims here

involved, in regard to the matters enumerated in finding of fact No. 6, do not involve the exercise of invention.

15 8. It would not require invention, especially in view of the patent to Zarotschenzeff to pass the refrigerant of Taylor over the food to be frozen in the form of a spray rather than of a bath.

9. Claim 31 is so drawn as to cover merely a desired result and, moreover, does not distinguished in any material respects from the product which would necessarily result from the employment of the Taylor process.

10. All the claims here involved are unpatentable in view of the prior art.

Conclusions of Law

1. The plaintiff is not entitled to a patent containing any of claims 9, 18, 19, and 23 to 31, inclusive, of his application No. 304,954.

2. The complaint should be dismissed as to all the claims involved.

DANIEL W. O'DONOGHUE
Justice

March 22, 1944.

* * * * * * * * * *

16 Filed Mar 22 1944

Judgment

This action came on to be heard at this term and thereupon, upon consideration thereof, it is, this 22nd day of March, 1944,

Adjudged that the complaint in this case be, and the same hereby is dismissed with costs against the plaintiff.

DANIEL W. O'DONOGHUE
Justice.

Approved as to form:
ARTHUR H. BROWN
Attorney for Plaintiff.

* * * * * * * * * *

II.

EXCERPTS FROM TESTIMONY.

(As Corrected by Stipulation)

27 **Harry A. Noyes**, the plaintiff, produced, sworn, and examined as a witness in his own behalf, testified as follows:

By the Clerk:

Q. Your full name, sir? A. Harry A. Noyes.

Direct Examination

By Mr. Brown:

Q. Please state your name, residence, and occupation. A. My name is Harry Alfred Noyes. My post-office address is 47 Maple street, Newton, Mass. My occupation is a research chemist and food technologist.

Q. You are the plaintiff in this action, are you not? A. I am.

28 Q. And are you also the inventor of the subject matter in patent application, serial number 304,954, involved in this action? A. I am the inventor of the process of this application.

Q. Briefly, state what college or scientific school education you have had? A. I am a graduate in chemistry, I majored in chemistry, Massachusetts State College, in the year 1912. I received my Master of Science in physical chemistry and science applied to plant-growing from the same college in 1914. I have studied since then botanical, biochemistry, chemical and engineering subjects at the University of Pittsburgh and at Purdue University.

Q. Where is Purdue University located? A. Purdue University is at Lafayette, Ind.

Q. If you ever had, or have now, membership in scientific or other learned societies, will you name those in which you have been or are now a member. A. I was a member and on committees of the American Society of Bacteriologists for several years. I am a member of the American Chemical Society and was chairman of the agricultural and food division of that society for a period of two years. I have been a member of the American Society of Agronomy. I have been a member of the National Society of Horticultural Science, a member of the Indiana Academy of Science, 29 several state horticultural societies, being at present a member of the Massachusetts one, and as I have worked in different States and with different fruit growers on their problems I have joined the state societies.

As for honorary societies, supposedly on the basis of attainment, I am a member of Sigma Xi, the National Research Society, and a national member-at-large of the honorary society of Pi Gamma Mu, which is economics and sociology.

Q. Have you published any written works, and if you have will you state in a general way their character, subjects, approximate number, and in what periodicals or publications they were issued? A. A full list of my publications would be something that I could not remember, because I have over a hundred published articles. My first article had to do with heat relationships, and was a joint article in 1913 in the Journal of Physical Chemistry. From then on I published in the Journal of the American Chemical Society, the Journal of Industrial Engineering and Chemistry, in the American Pharmacist, in the Journal of the American Society of Agronomy, in the Botanical Gazette, bulletins from the Purdue University Agricultural Experiment Station, and the annual reports; Chemical Age, and Journal of Agricultural Research, Journal of the American Society of Bacteriologists, Science, the Canner, the canning journal of the Can Association; the Canning 30 Age, and many other journals.

At the Mellon Institute, where I was a senior fellow, it was my duty to prepare the monographs on fruit juices and related subjects, presented to the Mellon Institute of Industrial Research in 1922.

I think that is at least a part of the list.

Q. That will do. Has your professional work included much or little in regard to the preservation and conditioning of foods? A. I went to Purdue University as research chemist and bacteriologist for the Department of Horticulture, because the Office of Experiment Stations at Washington had decided that it was time to approve a request for applying science to the chemical changes and the whys and the wherefores in fruits and vegetables and the preservation thereof.

One of my first projects under that appointment was canning Indiana apples. About the year 1914, as a physical chemist, and because of the osmotic loss—now, by "osmotic loss" I mean shrinkage during processing, whereby a can of canned strawberries would be half juice or maybe two thirds juice with the berries shrunken in the top, when you can them—I started work to try to get methods to prevent or i.e. for keeping a fruit as luscious, the same size as it was when picked from the tree or bush. I tried to do it by pressures and vacuums; I tried to do it by low temperatures, I tried to do it by all the concoctions of
31 physical chemistry I could work out. I did my first
freezing work in 1920, and from then on I worked at this problem to try and keep the full size, until the present time; and I think that covers part of this. I could add that while I was research chemist for the State of Michigan it was my duty to see that canned goods in Michigan were improved in quality from the soil through to the consumer.

Q. What recognition has your work had in the publications or compilations of well known people? A. I was lucky enough to be elected a Fellow of the American Association for the Advancement of Science, as early as 1916. I got a listing in Who's Who in America on the basis of my work as a horticultural chemist and bacteriologist and researchist before 1920; and a chairmanship of the food division, serving on various committees, and 20 years' industrial experience and consultant where my employers have sent me out to solve the problems of canning and preserving and helping concerns throughout the United States east of the Rocky Mountains, I would take these as recognition.

Q. What position in the art of food preservation is occupied by the invention set forth in your patent application, serial No. 304,954? A. The preservation of food is
32 one of the most important things that we have in
world economy today. I have had experience with processes called "smoking," "drying," "pickling," "canning," and "freezing." Under the processes that deal with freezing there are included various methods and procedures for carrying out the freezing and handling the product, and I have had contact and experience with this industry as it has developed and as changes have been made, from 1920 right up to the present time.

There is a selection of the food, there is the freezing of the food, there is the warehousing of the frozen food, the packaging of the frozen food, and then protecting that frozen food until it gets to the consumer. All these are important. All these things are not mentioned in most processes and in most procedures, because they compare freezing to canning. But in methods of selection, and the size of objects, people say only certain varieties can be used. The patent reference, the main one—Taylor—says he cannot freeze anything over three quarters of one inch, and certainly a method of handling foodstuffs should take things in, up to the size of 16-pound turkeys and melons, and therefore, since any one of these steps along the line can hurt a good job done in another place, I decided several years ago, before this application, that the freezing step should be considered and worked out, and the procedures for freezing were most important; and this process as described
33 in this application deals only with the product from
the time that it is subjected to the freezing operation until it comes out of that freezing operation.

Q. That is, in brief, it concerns simply the step of freezing? A. I wouldnt' call it one step, because in carrying out that one step there are several factors, the procedures concerned with carrying out freezing.

Q. What are the principal objects of the invention described in that application? A. As a practicing consultant and technologist in the refrigeration industry, I noticed that efficient cooling of liquids is done on coils where there is a small difference between the temperature of the primary cooling agent and that which is cooled, whereas in the air-blast procedures for freezing, for example, they use temperatures down to minus 40 below zero Fahrenheit, which is something like 60 to 70 degrees below the freezing point of the foodstuff.

Why this wide range of temperature was necessary gave me the objective of carrying out the quick freezing with the ice formation at as near the freezing point of the foodstuff as was possible; but more important than that is the main objective. The main objective is to take the ripe, luscious peach just as it hangs on the tree from the tree, or the strawberry, and get a method of making it inactive
34 so that it is just the same, except for the ice formation, as what it was on the tree, without loss of size, without loss of flavors, and without loss of constituents.

Q. Will you briefly describe the principal characteristics of the method involved in this application, stating them in general terms. A. This process has one very primary objective and accomplishment, which is, the refrigerant must work to the maximum right at the point of contact between that refrigerant and the foodstuff. That refrigerant, having properties and the capability to work rightly, wouldn't be worth much if its volume was not above certain limits that have been worked out.

That solution or that carrying away of heat from the foodstuff would not be worth anything unless the liquid as it is warmed up gets out of the way and new liquid just as cold comes on to the surface of the foodstuff. Further than

that, we must have a combination of conditions that aid or make it favorable for the production of the thing we are after, which is hardening that foodstuff; therefore, if we can make conditions so that ice is the compound that wants to form, that is normal to form by the laws of physical chemistry, and instead of just varying things we have made conditions so that there is a pressure for that ice to form,
and if there is any variation we still get the freezing
35 without the losses of the other processes.

Q. Will you describe in detail one illustrative mode of carrying out that procedure, referring if you wish to an example given in your patent specification. A. At page 27 of the specification, towards the bottom of the page, I give freezing strawberries by the rapid circulation of a solution where the freezing-point depressant is ''sugars and comestible extracts,'' and the temperature of operation plus 18 degrees Fahrenheit, and the freezing point plus 17 degrees Fahrenheit.

In referring to the diagrammatic representation of the process——

Q. Let me interrupt a moment. What diagram do you mean? A. The drawing that goes with the illustration.

Q. The drawing filed with your application? A. The drawing filed with the application. —this solution would be in the tank below the cooler. The pump would be started and that solution would be raised up into the chamber where the freezing takes place, and that chamber is shown as having an uneven distribution of sprayheads, many more sprayheads at the entering end.

Below the sprayheads are a perforated stainless steel belt—what we use—and that is slowly going through the
freezer, the product at any point, the solution comes
36 out of the sprayhead and goes down over the food-
stuffs supported in the air, not just flowing over it,
makes a contact right with the surface of the foodstuffs, flows at the surface of the foodstuffs, drops down below, and is followed by other solution, then is distributed over

a means of cooling that is shown there, and that completes the cycle.

Now, this solution would be applied at 18 degrees to the strawberries distributed on the belt, and if any osmotic action started, the loss by the osmotic action would put that solution right at the interface of the foodstuff where it joins the solution at the freezing point of the solution, and stop that osmotic action virtually completely, and then that warmed solution goes down below and is cooled.

In such an operation there is about 150 gallons of solution circulated at the rate of about 200 gallons per minute, and the strawberries would be loaded on the belt from three to five pounds per square foot, on the belt surface, and the freezing time would be somewhere around 15 minutes. We would probably gauge it to leave it 20 minutes, so as to have a big safety factor. Very quickly after they went in, the surface of the berries would be hardened, before the centers of the berries were hardened at all.

Q. In saying the surface is hardened, do you mean frozen? A. I mean frozen. I mean passing through
37 the zone that we speak of as "freezing," which is
maximum ice formation and known as the freezing point of the fruit. The point I will say I was bringing out there was that I make conditions for conducting heat away from the surface such that the heat is taken away faster than the inside of the foodstuff can replenish that heat, which gives the freezing right at the surface.

Q. What influence on the effect you have just last described have the volume and the rate of application of the refrigerant solution? A. I will illustrate by water. One pound of water lowered one degree let us say above its freezing point requires the extraction of one Btu—one British thermal unit of heat—but to change one pound of water to one pound of ice at 32 degrees requires 144 Btu's, 144 times as much. Now this freezing solution hasn't the specific heat of water, because it has the solid sugar in solution. It is down to about seven tenths, maybe 75/100ths. The berry has 10, 6, 8 percent of soluble solids.

Now the freezing is the changing of water into ice, and therefore I have got to have an immense capacity right at the surface of that foodstuff or the solution will be warmed up. I will say right here that in all immersion procedures the stationary liquid right at the surface of the foodstuffs allows it to warm up in a way that I cannot allow and
38 get my type of product.

Q. In the first paragraph of your patent specification it is stated that the freezing is done by the use of water-soluble constituents of the edible products, particularly "solutions containing their juices and water reinforced by sugars normally occurring in comestibles." What sugars are suitable for making or reinforcing those solutions? A. Any sugar or mixture of sugars that are compatible with the foodstuff to be frozen. As a general rule, we use sugars known as "sucrose," but particularly sugars that contain the constituents of invert sugar, dextrose, and levulose; some maltose has been used in some specific cases; lactose sugar has been used where you want a specific health value of a certain type of foodstuff, or food-fadism gives an objection to certain kinds of sugars.

* * * * * * * * * *

49 Mr. Brown. If Your Honor, then, will refer to claim 27, I would like to read that and ask the witness to explain what the other factors of the claim are, or how they apply to the disclosure of his application:

Q. Claim 27 begins with introductory language——

> "The process of quick-freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation."

Will you define "cytologically" as used in this claim? A. Take such a thing as a peach; there are cells that make up the skin. There are cells immediately below the skin that are different, and there is a pulp, then there is
50 the stone. "Cytologically" means "cells" as units, their components inside the cells. In other words, if

you should take a melon, there is a part of the melon that you eat, but you do not want to eat the rind; but a melon can be frozen in such a way that the rind material gets into the other part, and chemically it might analyze as a whole just exactly the same, but the part that you wanted to eat would be no good—it would be cytologically changed, functionally changed.

Q. So that the claim calls for "the process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising" the first step, "circulating alternately over a cooling means and the comestible until said comestible is substantially frozen, a refrigerant solution consisting of sugar and comestible constituents in water solution having a viscosity of not over approximately sixty-five centipoises at the temperature applied to carry out the freezing * * *."

The figure "sixty-five" centipoises of viscosity appears there, and I would like you to explain the significance of that limitation. A. I have found that if I put a solution in contact with a foodstuff that has above 65 centipoises, it is a measuring stick of the terms of measuring; I do not
51 get the character of quick-freezing that this process gives.

Do you want me to explain what a "centipoise" is?

Q. I think you might. A. A centipoise is just the measuring stick of resistance to flow. The standard is based on one cubic centimeter of liquid in the form of a cube, having above it a cover that is pulled across at the rate of one centimeter per second; and a "centipoise" is 1/100th of that amount of resistance. It is a term that is standard in texts for measuring resistance to flow.

Q. The next item of the claim represents "the freezing which falls within the temperature range from approximately plus ten degrees Fahrenheit to approximately plus twenty degrees Fahrenheit * * *."

What is the significance of those temperature limits of 20 degrees and 10 degrees? A. 20 degrees is the highest temperature that I have ever been able to use to get my character of quick-freezing without change in the natural characteristics of the foodstuff, even when I have the ideal conditions at the surface of the foodstuff to carry out quick-freezing. 10 degrees mentions a limit, a boundary post, not an operating temperature in the usual sense, because I have never been able to get a sugar solution with comestible extracts but what had above 65 centipoises below approximately 10 degrees and therefore would not give the
52 critical vital contact with the surface of the foodstuff.

That clause also says, "that falls within the range of 10 to 20," and I gave you as an illustration from the specification that in freezing strawberries I used a sugar solution at 18 degrees, which had a freezing point of 17 degrees.

I have used solutions at 19 degrees that had a freezing point of 19 degrees. I have used freezing solutions that had a freezing point of 16 degrees at 17, 16½, or anywhere close to it. In other words, it can be any temperature in the 10-20 range. I can't remember at this moment of ever having carried out more than one experiment where I used a 10-degree temperature.

Q. The next element of the claim is——

> "when the temperature of the refrigerant solution as applied to the comestible to carry out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, * * *"

What is the significance of the close approximation of freezing temperature and the temperature of application in that clause of the claim? A. The point is this: If a strawberry is giving up any juice at the surface, that little bit of juice at the surface of the strawberry will dilute the freezing solution, and if that freezing solution is at its

53 freezing point or very near its freezing point, the least dilution makes all the conditions so that juice is not going to move out in the solution, because ice will be formed at the interface, because that is the compound that is normal at that concentration and temperature.

It is a very important, it is a very critical thing. It isn't a compromise. On a thing like a strawberry you have got to get, not just temperature, not just viscosity, but you have got to get a condition at the surface where any force which tends to upset that condition of itself corrects by the dilution of the solution, bringing it to its freezing point.

Q. The next and further element of the claim reads——

"said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution * * *"

What is the significance of the "spray" and the "rapid and continuous replacement" of solution defined in that element of the claim? A. I used spray because immersion gives a stationary layer at the surface of the foodstuff. There is nothing else I can use than "spray". I can't get the contact or the pull of gravity and the dropping through the air by any other method than spraying, and the
54 volume and the continuous replacement have got to be, so as to conduct heat away from that foodstuff surface to the solution to the full capacity, i.e. faster than the surface can give up heat. Those are critical conditions for a thing like a strawberry.

Q. The final clause is——

"also said refrigerant solution is prayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen and back to the cooling means."

What significance has the two-degrees rise in temperature? A. If you were in Tennessee and had strawberries at 100 degrees and should put a solution on 100-degree strawberries at a low volume, the temperature of the solution can go a way up. Well, I have got to apply volume enough and have contact enough to keep it where no harm is done to my fruit and produce my ideal product. Therefore, I find that I want within a 2-degree range. I have got to have within a 2-degree range in a spraying process.

* * * * * * * * * *

56 Q. Were you acquainted with the Taylor and the Zarotschenzeff patents, cited by the Patent Office, before you prepared your patent application? A. I was not only familiar with the patents but I was familiar with the processes before they were patented.

57 Q. What influence did your knowledge of those patents have on the manner in which your specification was drawn? A. Considerable. Since those patents had been granted, I felt that it was necessary to point out what otherwise would be minor points in distinguishing from the art. For example, in many cases I brought out the film on an immersed article, and how that film about an immersed article prevents the necessary contact. Further than that, my employer gave me the task of trying to make the Zarotschenzeff patent work, and I tried that in three States, in two years, two seasons, and the Zarotschenzeff procedure was an entirely inoperable one even with the help of Mr. Zarotschenzeff.

I had no other patented spray process before me, and I quoted extensively from Zarotschenzeff for that reason.

Q. Now, referring to the Taylor patent, 2,164,362, what character of contact is described in that patent specification between the refrigerant solution and the food being frozen? A. The foodstuff is immersed in the refrigerant solution.

Q. Have you a copy of the patent before you? A. No, I haven't. I can get one. There is one in my briefcase there, if I had that. (Produced.) Yes, sir; I have a copy before me.

58 Mr. Brown: Your Honor, have you a copy of this?

The Court. Yes.

By Mr. Brown:

Q. Will you point out some spot in the specification of the Taylor patent where it mentions "immersing" in the specification? A. Example 1, column 1, page 2 of the specification says:

"Whole, suitably prepared, fresh strawberries were immersed in an aqueous solution of invert sugar in an insulated chamber."

Dropping down below to example 2, it says:

"under the same conditions"

—which means immersed. His claims are written to "immersion" in most cases. "Immersed" appears in the claims, also.

Q. Is Taylor's process as disclosed in the specification of his patent substantially like or unlike your process? A. Taylor's process is unlike mine. The only point of similarity that I can see is that he has a foodstuff that is unpackaged and he puts it in contact with a liquid refrigerant. His liquid refrigerant is one that I can't use. His contact and method of contact are entirely different.

My foodstuff is supported in the air where the forces of gravity pull on the surface film, and I found the vis-
59 cosities and the critical condition where that film moves entirely different than in an immersed solution. My procedure can use many kinds of sugar solutions. His is limited to a certain type of invert-sugar solution. He is limited by an upper limit of 10 degrees Fahrenheit. I am limited by an upper limit of 20 degrees Fahrenheit and do most of my freezing, or can do all my freezing at temperatures that are much higher, because physical properties are more important than temperature.

And the other point is, I have a way of getting heat out, conducted away from the foodstuff, by a type of contact that I have with the foodstuff, whereas he is limited by the conditions of immersion, where you have the stationary insulated layer right next to the foodstuff, and he brings it out in two places. One, he states that he must not have too great a layer of liquid on the foodstuff, and again he says that he can't freeze anything over one inch.

Q. Do you find those statements, and, if you do find them in the specification of the Taylor patent, where are they? A. Column 1, page 2.

Q. What line? A. Starting with line 29, he states:

> "In order to obtain a satisfactory rate of freezing, it is desirable that the units or portions of the foods being
> 60 frozen have at least one dimension not exceeding about ¾ to 1 inch."

Q. What do you find in the specification about a layer of liquid at the interface of the liquid and food, in this Taylor specification? A. In his specification he says that that layer shall not be, cannot be, over a certain amount, for him to carry out his process. That is on page 2, column 1, starting on line 2. I will read:

> "The greater the viscosity, the thicker will be the inert layer of liquid at the interface of the liquid and food through which the heat content of the food must be transferred."

Q. Have you made investigations which show the nature or character or rate of heat transferred through a layer of liquid in which a warm body is immersed between the surface of the body and the liquid at some distance therefrom? A. I have, many times.

Q. Will you just describe the results of any one of such experiments or investigations you care to make. A. I took an ordinary golf ball, smooth-surfaced and I cut a small groove around that golf ball, in which from one side I put

a string and tightened it up so that I could hold the ball by
a string. Then I put another string in that groove,
61 with the string being put at the other side. That was
my "object" that I was going to make the experiment
with.

Then I got some leaves of plants that had been air-dried and were very dry, and I ground those up in a mortar and sifted them so I had fine, dust-like and little larger than dust-like particles; that was the preparation of the two materials.

Next, I got a tank of about 18 inches diameter and about 16 inches deep, and I put in that tank a turbine stirrer, so that the "draw" was down, and coming up around. I found out, by confirmation, that I could control the temperature of that tank within half a degree at any point except right at the surface of the tank, where there is this film with the interface, and I put particles in the tank and showed they move around. I stopped the stirrer. I took my golf ball, and I dusted over the golf ball these particles, and I very slowly, so they could get wet, and so forth, lowered the golf ball, with a weight on the lower string to keep it in place, down into that solution.

A lot of the particles came away from the golf ball as it went into the solution, but after it got down there in the solution there were particles all over the golf ball. I started the stirrer. Some particles came away, a few.

Then I took my light and watched, and I could see a little
motion on long particles sticking out, which were, I
62 will say, about three millimeters, and some of those,
eventually—this was water solution—would wiggle
off and go. Others, right at the surface of the golf ball, had no motion at all. Stopped the stirrer, pulled up the golf ball, and I had to be very careful in pulling up the golf ball in those experiments, because if I naturally do them in a hurry, as it came out of the liquid the pull of gravity around that film on the outside pulled off a whole lot of the particles left; so I pulled that ball up very slowly, with some of the material left on it.

Then I transferred that over under a spray, and immediately the material that was left went off, on the golf ball. Then I took the golf ball, and I wet the particles and put those on a dry golf ball. Then I put wet particles on a wet golf ball, and I conducted all kinds of combinations that I could, from my experiences as a consultant engineer, and I found that the actual surface of the golf ball had a moving liquid right at it, that washed off the particles, when I was spraying the golf ball; but my experiments the other way showed that there was an inert, stationary layer of liquid right at the golf ball; and that is no different than the facts of science; and so this immersed condition can't be any different, by my test and experience, than the textbooks teach, than I was taught, and than I have worked out in selecting processes.

Q. What temperature measurements, if any, have
63 you made as to the temperature difference between a
fruit substance sustained in a moving, chilled refrigerant? A. You mean, if immersed in a refrigerant?

Q. And if immersed in a refrigerant which was circulating around, circulating by the object. A. I find three distinct and separate zones: the temperature of the circulating solution, a higher temperature in the stationary film around the foodstuff, and a temperature of the foodstuff at its freezing point while it is freezing. For example, take a small tomato. A tomato may be freezing at a temperature of 29 to 30 measured on a thermocouple in the center of the tomato. You have another very delicate thermocouple, a very delicate instrument, and you put it up against the edge of the tomato. That temperature will be below 29 degrees, but above seven, five, or anything else, your solution is. It may be as high as 20 degrees, while out in the solution where it is circulating, as water flows in a pipe, you will find the temperature will not vary over a half degree, and never over a degree in a good operation.

Q. In the Taylor specification, page 2, column 1, lines 37-52, an operation is described in which fresh strawberries were immersed in a solution having a viscosity of approximately 400 centipoises. Will you state whether or not a solution of that viscosity would adhere to the surface 64 of strawberries even when the solution is caused to flow past the berries? A. My answer is that that solution cannot be sprayed in the process as described here. There is a film that is stationary right next to the strawberries, which is warmer than the solution that is being circulated, which is further out.

(Brief recess.)

Q. Did I understand you to say at one point in your testimony that your process would not be operative at a temperature as low as 10 degrees? A. My process is operable at 10 degrees, but of course it is not operable at 10 degrees if I am using a solution that has a freezing point of 15, but the process is operable at 10 degrees with a solution that has a freezing point of about 10 degrees. But that's the limit; the product would be better at higher temperatures and better conditions as a rule.

Q. I will call your attention to a passage in the specification of the Taylor patent, from page 1, column 2, beginning with line 41. This passage states that——

> "The viscosities and freezing points of invert sugar solutions may be lowered by removing a portion of the dextrose, for example, by crystallizing out some of the dextrose, * * *"

65 Q. Is that a complete and accurate statement of scientific fact? A. That is not a complete and accurate statement of scientific fact, because just as soon as anything is taken out of a solution, the solution is changed, it is no longer what is was before.

Q. Is the reverse of that statement, namely, that "viscosities and freezing points of invert sugar solutions may be raised by the addition of dextrose," true as a scientific fact? Can the viscosities and freezing points of invert sugar solutions be raised by adding dextrose? A. A solution with more dextrose added, at a temperature that it is in solution, would have a higher viscosity, but adding dextrose to a solution, if it is less than eutectic, lowers the freezing point. If on the solubility curve it has no effect on the freezing point. That is not a true statement, without an explanation.

Q. What is the law of physics which governs the effect on the freezing point of water resulting from dissolving a simple matter in the water? A. We have a rough principle, which is this—that the molecular weight of a substance, with 1,000 units of water, lowers the freezing point a constant, and that means that a substance that has a molecular weight of 30 would lower the freezing point with 1,000
66 grams—30 grams of that, with a thousand grams of
water—would lower the freezing point approximately the same as 420 grams of a substance that had 420 as a molecular weight when that was put with the 1,000 grams of water; so molecular weight is an important thing.

Q. In the illustrative example given in page 2, column 1, lines 40-42 of the Taylor patent specification, it is stated:

> "The solution contained 57% by weight of invert sugar and had a freezing point of 0° F. and a viscosity of approximately 400 centipoises at 8° F."

It is stated that that was used for freezing fresh strawberries in an immersion process.

Will you state whether the solution there described is usable for freezing strawberries and the like by your process? A. That solution is absolutely and positively not usable in my process.

Q. Why not? A. That solution has a freezing point of ero degrees Fahrenheit. I cannot have a solution that has much below 10 degrees as a freezing point to get the proper contact with the fruits. That solution also has 57% of sugars, and I have never been able to devise or make a mixture of over approximately 50 per cent but what I lose the critical contact between the foodstuff and the fruit.
67 400 centipoise at 8 degrees Fahrenheit cannot come
into my range if it is warmed up.

Q. Would the solution mentioned in that example which I have just quoted have the same viscosity as your sugar solutions at 10 degrees Fahrenheit? A. Absolutely not, as the result of experimental work and scientific facts and the literature and all knowledge.

Q. In Taylor's specification, on page 1, column 1, lines 46-48, the freezing point of strawberries is stated to be about 13 degrees Fahrenheit. Have you ever determined for yourself the freezing point of strawberries, and, if you have, what did you find the freezing point to be? A. I have determined the freezing point of strawberries many times, and commercial strawberries will be—29½ plus or minus half a degree Fahrenheit, for the usual run, and sometimes a little above 30 degrees, is my experience.

Q. Please cite if you can disclosures in published literature which confirm your experimental results as stated in your last answer. A. The Refrigerating Engineering Handbook, the fifth edition, published in 1943, gives the freezing points of many foodstuffs, and I have a copy of that. I have a copy of that data here.

68 Mr. Brown. I now offer in evidence photostats of pages 205, 206, and 207 of the Engineering Handbook referred to by the witness, as exhibit 7.

The Witness. That is the refrigeration data book.

(Pages 205, 206, and 207, of the Engineering Handbook referred to, contained in two photostats, were marked as Plaintiff's Exhibit 7 and were received in evidence.)

By Mr. Brown:

Q. Will you state whether or not that handbook is entitled to credit. A. I am going to state that the data that I have here from the handbook is entitled to credit because, with string beans and peas and tomatoes and blackberries and raspberries and carrots and strawberries and other products, the figures that they give are what I have experimentally found.

Q. Is there an example in your patent application where you use a solution to freeze strawberries, where the temperature of the solution is substantially higher than the temperature Taylor assigns as the freezing point of strawberries? A. Page 27 of my specification gives an example of using a solution at plus 18 degrees Fahrenheit, which has a freezing point of approximately 17 degrees Fahrenheit, which is more than two degrees above the freezing point that Taylor gives for strawberries.

Q. Have you tested the procedure of freezing
69 strawberries and other fruits similar to that de-
scribed in the Taylor specification? A. I have.

Q. What did you find that the freezing point of strawberries is, as determined by that procedure? A. Between 29 and 30 degrees.

Q. How did you determine the freezing point? A. With a thermocouple, in this way—following the standard methods of the literature and the arts; which is, to insert a thermocouple below the surface of the fruit, and the thermocouple goes right down in temperature, in almost a straight line, and then there is a zone that it is horizontal, and that zone with everything is between 25 and 30 degrees, and then after it stays there a while it drops down rapidly, and in the art and in the literature and in science we consider that point at which the level line occurs the freezing point where the latent heat of freezing is being extracted, and on strawberries that is between 29 and 30 degrees Fahrenheit.

I can supplement that. You asked me the Taylor process?

Q. I did. A. There is another way of getting that same figure.

Q. Where you speak about the "line," do you mean that the thermocouple draws a line, or that you have to? A. You
make the line by transcribing the data that the ther-
70 mocouple gives you. In other words, you read the
thermocouple every half minute, or every quarter of a
minute, and set it down, and you will find that as it starts at room temperature, every quarter of a minute it goes

down. It goes down in temperature until a point is reached down between 29 and 30 degrees, where the next half minute would show approximately the same temperature; I mean within a quarter of a degree. You see no appreciable change. Then, the next half minute would show the same thing. The next half minute, it may go on, depending on the size of the berries and your conditions and so on, for some length of time. Then it drops rapidly again. That is recognized in literature as the freezing point of the food.

If I would be allowed to, I would like to say one more thing about the freezing point of strawberries, and that is this—that if you put a strawberry in a refrigerator at 29 degrees and hold that, it will freeze.

Q. Have you proved that? A. I have done it many times.

Q. In the Taylor specification, page 2, column 1, line 48, with the same example we referred to before, it is stated that "the refrigerant solution circulating in contact with the strawberries sustained a drop in temperature." Can you explain how a refrigerant solution in contact with warm
berries would be lowered in temperature? A. I know
71 of no case where something that is put on to extract
heat, as that solution is, works "back end to," so to speak. I think that is a typographical error. I think he means one degree rise in temperature, and I would accept it as such.

Q. Assuming then that the word "drop" is a typographical error and that "rise" should have been used, how do you account for the apparent differences between this statement and what you have testified previously as to the difference in temperature between the surface of berries immersed in the solution and the temperature of the solution? A. Doctor Gootch, of Yale, once said to me that "Chemistry is an experimental science; you get facts by experiment." I have put a thermocouple right at the edge of a strawberry in an immersion procedure and I always got more than one degree rise over the temperature out in the solution where the inert film does not exist. And I can't go back on that, because I have done it so many times.

Q. Would the one degree difference of temperature rather refer to the average temperature of the refrigerant solution, in your opinion? A. It did. It does refer to the refrigerant solution, where there is free circulation; not to the interface of the berry.

72 Q. In the case of berries frozen by immersion, how did the frozen berries compare approximately with the berries previous to immersion and freezing? A. Berries frozen by immersion are depleted and changed. They do not come under the requirements of my product. That is why I had to work out my process, because I couldn't use an immersion procedure. They are shrunken sometimes at the edge, as I have known berries. As a rule—you can measure the diameter of a berry with a pair of calipers roughly. You take three or four measurements, and turn that berry over—which is representative—and you put it through an immersion process, and that berry sometimes has shrunk ten percent in diameter. If it is a large berry it may shrink more than that. It always shrinks, in my experience, as much as five percent; and five percent means 14 percent loss of weight as a rule.

Q. And how did that shrinkage compare with the effect on berries frozen by your process? A. I get, in lots of cases, less than 2 percent shrinkage; and if I am working on a plum, or with something that has a skin, I get practically none; and with very juicy, over-ripe berries, I have had it run under four percent, because of my interface contact with the freeflowing solution.

Q. The Taylor specification, in page 2, column 1, lines 29-33, states:

73 "In order to obtain a satisfactory rate of freezing, it is desirable that the units or portions of the foods being frozen have at least one dimension not exceeding about ¾ to 1 inch."

What, to you, as one skilled in this art, is the meaning of that statement, and the significance of it? A. Speaking as a food technologist and one skilled in freezing foods, it simply means that the stationary layer around his immersed object, under his conditions, so depletes the foodstuff that it is not much good, if it is over one inch in diameter.

Q. Is your process limited in any such manner to pieces of a small maximum diameter or thickness? A. I have frozen watermelons, muskmelons, 16-pound turkeys, small blueberries. I do not consider, would not consider I had a process, unless I could take the ordinary foods in their ordinary sizes in nature; and by doing that we get an advantage, because we can freeze whole peaches and whole melons.

Q. Does the fact that the Taylor specification says that invert sugar solution is used and that you also use sugar solution mean that the viscosity of the Taylor solution and your solution must be the same at the same temperature?

A. It does not mean that they need be the same. The
74 literature on viscosities of sugar solutions is very
limited, and I have had to go to work and create to get the facts. In my work I find that a higher concentration of sugar of a kind at the same temperature means a higher viscosity.

On page 13 of my specification I have two tables that were put in there because most of the data in those tables is not in the records anywhere. And there is a 55% invert sugar solution shown in table 2, I think.

Q. That is right. A. And its viscosity, at 35 degrees Fahrenheit, which is above where any freezing can be done, is higher than my upper limit of 65. If I recollect, doesn't that say 67, or something like that?

Q. That shows 66. A. 66. It is just over; and when you get down to five degrees lower, it goes up; and a 57% invert sugar solution I know by experiments that I have made is higher, no matter what its components of dextrose and levulose, than a 55%; and since that solution cannot get in my range, I am positive that no Taylor solution can get in my range of viscosity at any temperature that I have disclosed.

Q. Does the Taylor specification describe any procedure
in which a solution is used at a temperature as high
75 as 10 degrees Fahrenheit? A. I have never seen the
Taylor process used, and I do not find in his specification any example that gives as high as 10 degrees. The specific example, using a sugar solution, is a sugar solution that has a freezing point of zero, used at—let me check a minute—five degrees, approximately, and that five degrees would mean within one degree, if we make that interpretation of the rise in temperature; so his would have to be about four, and below six.

Q. What is the highest freezing point solution described in your specification? A. The highest freezing point solution in my specification that I recall at the moment is the one of approximately 17 degrees—that is on page 27; there are other illustrations.

Q. It says 18 degrees—18 degrees, on page 27. A. 18 degrees is the temperature that I use at the freezing, but that solution actually freezes at 17 degrees.

Q. Will you describe experiments, if any, which you have made, in attempting to apply by a spray apparatus solutions having greater concentrations and greater viscosity than those described in your specification. A. By a spray process?

Q. By a spray process; yes. A. We made up solutions
of sixty percent sugars on the high levulose side. We
76 put them in apparatus with 20 horse-power motors
and big pumps, and started them at temperatures of say fifty degrees. Then when we try to lower the temperature of the solution, and the solution does not flow, it does not spray, long before you get down to 32 degrees, so we let heat in, by letting the thing stand a little while, add a little water, bring it down to 57% sugar, for example, try it again, and before we get down to the twenties—down to 30—the apparatus just doesn't work; and just before it

"drips" or doesn't work, or go through the nozzle, because of the high viscosity, there will be a little piercing stream that will come out of each nozzle. Then we will reduce it to 55 and 53.

No, in spraying strawberries even with high pressures the 57% solution just doesn't work in the apparatus, and further than that, that kind of viscosity fails to give the flow on the surface of the foodstuff that is required to carry out my quick-freezing.

Q. Have you found in the Taylor specification any statement as to what the optimum temperature is for carrying out freezing by the process described there? A. I find no statement that gives one specific optimum temperature. He does state that the frozen product should be stored at zero,
and his range is from zero up to 10; but he gives no
77 optimum temperature in his range from zero to ten,
at which the refrigerant should be maintained. His
example is five degrees.

Q. The word "optimum" is used in the Taylor specification on page 1, column 1, line 9, and line 22; also, on page 2, column 1, line 67. What is the optimum which is referred to at those points? A. It refers to the optimum—well, now, on page 2, line 67, it says—

> "a suitable rapidly circulated liquid maintained at a temperature above the optimum temperature and substantially below the freezing temperature * * *"

Q. "Of the food"? A. "Of the food." But going back to the other reference, it refers specifically to the warehouse storage temperature of the food.

Q. I will refer you to the Zarotschenzeff patent, No. 2,140,043, also relied on for rejection of your claims. What specific example do you find in the specification of that patent of any freezing process? A. Will you repeat that question, please?

Q. I say, what specific example do you find in the specification of the Zarotschenzeff patent of any freezing process

or example? A. He has what he calls "examples" and what
he calls "specific example," but if you mean, what do
78 I find, here, expressly, of "freezing process"—
Q. What can you find in the specification? A. I
can find nothing that is operable.

Q. Do you find the illustrative example mentioned in page 2, column 1, beginning with line 20? A. Yes. He gives an illustrative example of 50% fruit juice and 50% sugar, with the requirement that you obtain the lowest possible temperature. He does not specify in that example, there, that that is a spray process, or an immersion process, or a brushing process; because he has a paragraph later on in which he says:

> "Instead of spraying the product to be frozen, it may, of course, be dipped, brushed, or otherwise covered * * *"

That is lines 32-34, column 2, on page 2.

But he is working for the lowest possible temperature. That means he is working for the highest possible viscosity that he can get with that sugar, which is directly contrary to my experience and findings.

Q. The illustrative example describes "50% sugar and 50% fruit juice." That is in reference to strawberries. Does strawberry juice contain sugar? A. Strawberry juice contains sugar, varying with the variety and the season.

Q. Then what approximately would be the range of
79 sugar contents of a solution made of 50% sugar and
50% fruit juice. A. In my experience it would be
from 54 to 64 percent soluble solids—could be from 54 to 64 percent soluble solids—approximately. May I add the word "approximately" there?

Q. Certainly. Would such a solution be usable in your process? A. I have made up such solutions, and the viscosity is too high for them to have a proper contact with the surface of the foodstuff.

Q. What definite disclosure do you find in the Zarotschenzeff specification as to temperatures, viscosities, contact with refrigerant, or procedures in carrying out a freezing operation? A. "Lowest possible temperature." And your next point was what?

Q. Viscosity. A. No mention of viscosity.

Q. The next point was "contact with refrigerant." A. Only the general term, the spraying, dipping, or brushing being equivalent. "Volume of refrigerant," nothing.

Q. And as to any definite procedure? A. No definite procedure.

Q. I will refer you again to the example in the
80 Zarotschenzeff specification, page 2, column 1. It is
stated, beginning with line 23, that the amount or proportion of the sugar and juice is so regulated as to obtain the lowest possible temperature of the refrigerating medium, without freezing it solid. Now, will you tell about what would be the composition of a sugar solution with which the lowest possible temperature can be obtained before freezing? A. I can give the results of experiments on that point. The sugar solution is soluble to the extent of sixty percent, and the fruit juice, the minimum fruit juice concentration added to that means 64%, and if you get 14% solids or 10's soluble solids, it carries it up into the 70%. I have actually made up one that had 71 or 72 percent.

Q. Do you remember to what degree that solution could be lowered in temperature before it froze solid? A. No, I do not, for this reason, that when you put fruit juice with the sugar, and you get those high concentrations, you have got to wait a long while to get over the effects of supercooling, and so forth, and it gets very viscous and very hard; it may be the next day before you get it. No, I did not determine it. I know it is lower than ten degrees.

Q. What if any efforts have you made to put the disclosures of the Zarotschenzeff specification into practice?
A. I was employed as food technologist and consult-
81 ant by Arthur D. Little, Incorporated.

Q. Where are they located? A. They are located at Cambridge, Mass. I was employed by them for several years. The Z Pack Corporation, the owners of the Z. process, were clients of Arthur D. Little, and they gave the task to Arthur D. Little, to run a process with the lowest possible temperatures, in accordance with the specifications of this patent, and I was the man who was sent out to try and make it work, in the years 1938, '37 a little, and in Tennessee, in New York, and in Maryland and New Jersey; and uniformly I was never able to get a decent frozen product, by carrying out the specification. We did compromise somewhat and not have the lowest possible temperature, but we never got an undepleted product of the type I have claimed in claim 31.

Q. Did you have any assistance from the inventor of this Zarotschenzeff process when you made those attempts? A. I know Mr. Zarotschenzeff very well. I was to contact him, and did contact him; he visited me; and "lowest possible temperature" was what he said; and viscosity—he wasn't concerned about viscosity—"Build the machine right."

Q. Are you stating what Mr. Zarotschenzeff said to you? A. I am stating my—wait a minute; I am not putting, can't
put it, in direct quotations, because Mr. Zarotschenzeff
82 is a Russian, and this Mr. Zarotschenzeff, being
a Russian, has his way of expressing. Mr. Zarotschenzeff was not concerned about viscosity, and he wasn't concerned about the contact of the viscous solution on the product; and I found him of no help.

Q. Can you testify to the general effect of what he told you?

Mr. Reynolds. Just a second. I think that is hearsay.

The Court. Yes. Objection sustained.

By Mr. Brown :

Q. Did you have engineering help in making your endeavors to operate the Zarotschenzeff process? A. I did. I had the engineers, and machines built by the company of which Mr. Zarotschenzeff was technical director.

Q. Will you describe the effect or the result of one or more of your attempts to put this procedure into operation, as to the effect on the substances subjected to the refrigerant, also describe the manner in which the refrigerant was applied? A. I will give an example, of June 1938, specifically, at the plant of Westfield Planters, in Westfield, N. Y., in a portable Z. machine, where the operation from an engineering point of view was supervised by the engineers of Z Pack Corporation. Do you want the name?

83 Q. I just want the experiment and the effect. A. We put in the machine a solution of about 52 percent sugars, and started circulation. It would not spray, so they yanked out the motor and doubled the horse-power, speeded up the pump, and put on very high pressures, to get that solution through the nozzles and on to the fruit, and when they got a temperature down in the range of ten degrees, they begun to put berries through—on a belt that was four foot wide and 20 foot long, above which were four pipes, and out of each pipe in each direction came a nozzle. That meant that there were eight rows of nozzles as you looked lengthwise of the machine.

They ran the machine—had everything cooled down to that, and ran it, and when the first berries came out there were eight rows right down through the machine where there was nothing on the belt, and the berries had been piled one inch or more deep. They had been disintegrated by the drive of the liquid. It wasn't a spray. Just beyond that were parts of berries and pieces of berries that had been partially disintegrated; and in between there were berries that were not frozen at all.

Q. Does the Zarotschenzeff specification tell you what temperature could or should be used other than the "lowest possible temperature"? A. It does not.

84 Q. Does this patent specification give any instruction as to the rate in which the solution should be applied to take the heat away from the foodstuff? A. It does not.

May I go back on that, Mr. Attorney? He gives "brushing and dipping and spraying" as alternates. He does not give any rate above enough to cover the product with a film; and that's a very indefinite statement. That's on page 2, column 2, in the lines of the 30s; I will find it specifically here—

"provided the latter completely covers the product"

That is lines 34 and 35, on page 2, column 2. That is as near definite as I could find.

Q. Would you consider that sufficient to instruct you as one skilled in the art how to produce frozen products which realize the object of your process? A. It is not. If you should ask me at the present moment, after I had made my invention, what one skilled in the art would do, of course I would bring in a volume of solution much in excess of the spray, "fog," or "drive" that he had; but it isn't proper instruction for the art, and hasn't been, wasn't operable.

Q. The specification of the Zarotschenzeff patent contains in page 2, column 1 some discussion on the
85 proposition that by using fruit juices as a refrigerant osmotic action will not occur. That is, he says specifically in line 48 of that column that no "osmosis action" will take place. Is that statement true, if the fruit juice is reinforced with the addition of sugar? A. That statement is not true. Not having an operable process, on all attempts the osmotic losses were high.

Q. In line 45 of the same column it is said there would result an equilibrium between the juices contained in the fruit and the juices used as refrigerating medium. Can there be any such so-called "equilibrium" if the concentration of sugar in the exterior juice is different from that within the fruit? A. Not until after osmosis has depleted the foodstuff.

Q. On page 1, column 2 of the Zarotschenzeff specification, beginning with about line 45, it seems to be stated that the fruit juice alone may be used as a freezing liquid. What do you say as to that? A. There are many statements in that patent specification that I do not find plain, clear, and uncontradictory with fact. There is an implication there that you could use a fruit juice as the freezing medium. Of course that isn't so because it would have the same freezing point as the fruit itself.

86 Q. At page 2, column 1, line 2 of the Zarotschenzeff specification it is said, "I may employ sugar, alcohol, glycerine," as agents for lowering the freezing point. Did you make experiments with either alcohol or glycerine in attempting to apply the process of this patent? A. Yes. We had a small apparatus that would freeze, that was hooked up to a 5-ton refrigeration machine, and we had a sugar solution, and of course in all these tests we had sugar solutions, and then tried to get rid of the viscosity in fact we tried to add alcohol. We decided that we couldn't afford to add alcohol in sufficient quantity to work direct. The alcohol threw sugars out of solution by changing the solubility, and upset the tests.

And then we have added glycerin, but when you work to get the lowest possible freezing point with alcohol or glycerin, you are going down to pretty near all alcohol or glycerin, and with glycerin you are going down to things that virtually have no free-flowing at all at the temperatures that are produced, and besides, they have an effect on the foodstuff to such an extent that alcohol and glycerin are prohibited by our Food Laws in contact with foodstuffs.

Q. What can you say about osmotic depletion with the use of alcohol or glycerin? A. They deplete osmotically. Alcohol gives very rapid osmotic-depletion. 87

Q. Will you just state in general terms what the law of osmosis is. A. The familiar example of osmosis is carried out in every botanical class, namely, they will put some molasses inside a tube and have a semipermeable membrane, egg white or something of that kind, that confines the molasses, and they will set that in a dish of water, and the molasses slowly rises up in the tube and eventually it will rise very high. That is called "osmotic pressure."

Now, to put it down in simple, as near as I can one-syllable words, it is this way—substances simply move from places of high concentration to those of lower concentration, and in their movement create a pressure. For example, if the strawberry juice has four percent of sugar and the freezing medium has 54 percent of sugar, by the law of osmosis or the principles of osmosis the strong sugar on the outside would move inside where there is less sugar; but in the strawberry there is about 95% water, so the concentration of water in the strawberry is 95 and the concentration of water outside, if I said 54, is 46 percent, and water has a very low molecular weight and high mobility, so the "traffic" is from the foodstuff out, and quite rapid; in fact so rapid that it is some time before you can gauge and measure any movement of sugar inward.

88 Do you want me to illustrate that in an immersion procedure, with a piece of pineapple that is three inches in diameter?

Q. If it doesn't take too long. A. A piece of pineapple three inches in diameter with a thermocouple in the middle of it, is immersed in an even high strength sugar solution the temperature held down to 15 degrees, and circulated as rapidly as you can. Osmotically the 3-inch hunk of pineapple shrinks and shrinks and shrinks, as the solution can't conduct heat away from it so that the thing freezes at all. In other words, you osmotically deplete that pineapple until its freezing point goes a way down.

Q. Do you find in the Zarotschenzeff patent specification any disclosure of an operable, workable process? A. I find no disclosure in patent 2,140,043 that is operative.

Q. Referring to claim 1 of the Zarotschenzeff specification, the last portion of the claim, referring to refrigerated solution consisting of sugar and juice, says—

"that freezes the product without affecting adversely any of the natural properties of said product."

What disclosure do you find in the specification of the Zarotschenzeff patent which justifies that statement? A. None.

Q. In view of your experience, what can you say as to the feasibility or possibility of freezing with the solu-
89 tion described in the Taylor patent by means of the spray device mentioned in the Zarotschenzeff patent? A. The Taylor solution just does not circulate, does not spray, and doesn't give my desired product and required product in a spray apparatus. Really I do not know how badly, how far that is off, because the viscosity of the Taylor solution is so high that you never can get it to circulate in the spray machine that we built or tried to build.

Q. Will you demonstrate if you can that you have by your process succeeded in effecting proper contact at the surface of comestible bodies with the result of causing progressive quick-freezing from the surface inward. A. I can do that with a report on experimental work that I have here somewhere. (Produces same.) I would like to introduce or describe those, give them those graphs so that they may see them.

Q. You have produced a chart. Will you tell me who made it and what it represents. A. I made the chart, I did the work, I took the data, and it represents that you freeze the surface of the foodstuff.

Mr. Brown. Will you excuse me just a minute? I wish to offer the chart produced by the witness, in evidence.

(The chart referred to, entitled "Quick" Freezing,
90 Noyes Method on Fullgrown Fowl, was marked as Plaintiff's Exhibit 8 and was received in evidence.)

A. I would like to explain that in detail if I might.

This chart is a photostat of the original, a copy of the photostat, and is entitled "'Quick' Freezing, Noyes Method on Fullgrown Fowl." At the top of the chart we have the number of minutes from the time the spray is turned on listed as .0, 20, 40, 60, 80, and so forth. At the left of the chart we have temperatures from 15 degrees to 90 degrees Fahrenheit outlined.

The other general principle of the chart is, from just above 30 to 25 is a zone that is called the "freezing zone," "Zone of Maximum Ice Formation." That is an accepted thing and it is worked out, there. The freezing would be the time it takes to go through that zone.

Taking the lower curve, the lower line, which starts at a little above 35, taking the dotted line first, that is of a thermocouple in the center of a 5-pound fowl, uneviscerated, several inches away from the surface, more than two inches from the surface one way, and double that probably the other way, from either end. Every five minutes, I took thermocouple readings of the temperature at that point.

Now you will note that very soon that fowl goes down into the ice-formation zone, and it hangs there and does
not go out of that zone, at the center of the fowl,
91 until you are about up to 180 minutes, or three hours
in the freezer. Now, the line above that starts—and that was of a sister fowl, the same heredity, the same feeding, and the same all the way through. But that fowl was allowed to stand until the thermocouple in the center showed that the body temperature had gotten down to 60 degrees at the center, and we ran that the same way.

Now you will notice that that line hasn't the long horizontal zone in the maximum-ice zone.

The 90 degree is immediately after killing, or as soon as we could get it in the freezing spray after killing.

Now, what is the significance of that? Now I go to the three solid lines at the left of this graph. They are from very sensitive multiple recording thermocouples, placed just beneath the skin of the bird, and this thing has been repeated several times, and you see that the skin of the birds goes down in temperature right through the ice-formation zone and down to the 15 degrees. I think the longest time shown there is 12 minutes.

That simply means this—that I have made conditions in my process at the interface where the liquid hits the product such as that heat is conducted away from that product more rapidly than the interior of the product can give it up. As a result, and the conditions of the
92 solution, the surface has to form ice.

So, freezing objects by my process cellularly unchanged means what? That you encase the outside and freeze it, and since ice is a better conductor of heat than the unfrozen, and you have got plenty in excess of liquid content on the outside, rapidly moving, cell by cell, layer by layer, the frozen state goes inward, and every point goes through the quick-freezing zone rather rapidly, or at least rapidly enough in large objects such as this, to be called superior quick-freezing.

Q. And does that same principle hold true of strawberries and other small fruits? A. It holds true. Wait a minute—when you get down to a half-inch strawberry or a quarter-inch strawberry and you study the volumes of solution in relation to surface, the spherical objects would take at least half the time, use twice as much liquid. Why, a green pea goes down instantaneously in temperature and freezes almost immediately, as does a half-inch strawberry or something like that; but let's take a peach. Now the skin of a peach is different, and I have taken peaches, where there would be 10 percent of the diameter frozen, 20 percent of the diameter frozen in a certain length of time, and I have taken those peaches out and sectioned them, done everything to them, putting them down to the 20s, while getting my results. I am taking each zone in
93 its turn. They are quick-frozen, without morphological, physiological, or cytological change.

Does that answer you, sir?

Q. I think so. I want to ask you if there has been any sale of product frozen by the process of your invention? A. Yes. In 1940, I was privileged to run my process six months or so after this application had been filed, on a Z.

machine that was mentioned, and the product, strawberries, frozen on that machine brought a premium price.

Mr. Brown. I think that is all, Mr. Reynolds.

Cross Examination

By Mr. Reynolds:

Q. Did you say that you couldn't use a freezing solution at a temperature lower than 10 degrees Fahrenheit in your process? A. Not to produce the product, lower than 10 degrees; doesn't produce the product of my claim 31.

Q. On page 27 of your application you describe an example in which it says:

"The temperature of the freezing solution is kept in a range of from a low of plus 7 degrees F. to plus 10 degrees F."

Kindly explain that. A. I had several years experience with patent and associations, and it was always
94 policy with us to draw a specification covering so there is no exact borderline. I haven't claimed that, sir.

Q. Well, that is a specific example that you give, isn't it? A. Yes, but it is under, if you will read that—may I read that example, and I can point out why that example is in there. That's easy—if I may find my copy. Page 27. Now, will you please tell me where you want me to begin?

Q. Well, it begins on the bottom of page 26, the example. A. (Reading)

"A high levulose solution such as the one designated as No. 5 may be started with for freezing strawberries. This, for example, is where it is desired to make especial products from sorted berries of selected colors and sizes. To have as little water as possible go into the freezing solution, the fruit is washed, spread out and allowed to dry before being hulled. After hulling (capping) the berries are placed in the freezing chamber. The berries are loaded up to three deep and run through the freezing apparatus

as the (1) example except for being a shorter time in the
freezing chamber. The temperature of the freezing solu-
tion is kept in a range of from a low of plus 7 degrees F. to
plus 10 degrees F. Reinforcements of the freezing
95 solution are made when the freezing solution throws
out solid on the heat exchanger at temperatures of
around 10 degrees F. The solution is reinforced by adding a more concentrated solution carrying the proportions of dextrose to levulose and by concentrating the weakened freezing solution by freezing out water as ice."

That is a specific "show" example, that has a mistake in it that was pointed out in the request for reconsideration. Gentlemen, I can't tell you how I wrote down a solution as "example 5" in my list of solutions, at about page 14 or 16—I wrote down "example 5," and I wrote down "55 percent sugar," and then I checked, and made my additions come to 55, when as a matter of fact in the original and all, and what I meant was "52," which would give you the "7 degrees" here.

But that solution, you must notice, in this example, takes in consideration that most of the time the freezing point is up close to 10 degrees, and when it separates out ice it shows that there is a range from the 7 to 10 degrees of operation. You put a solution in, and it is 7; a little osmotic action takes place, and it is 8; a little more, and it is 9—it is up to 10; and it is reversed when it gets up to 10.

It is a specific border-line example for a specialized product, that I have not claimed.

96 Q. But you would say it gives satisfactory results,
wouldn't you? A. I couldn't claim it as a product,
no; and I couldn't claim the product in my claim 31.

Q. Well, you do not mean that you put in an example that you knew was not satisfactory, do you? A. I put in an example out of the commercial range of dry berries, that had been washed and dried for special purposes, to emphasize the keeping the freezing solution at near its freezing point.

That's the best I can answer you, sir, on that point, there; but, in other words, a specialized case, going over the line; and that would not give the product of my product-claim, it would be depleted more than that product-claim would allow; but that is desirable for specialized purposes.

Q. You testified, did you not, that you could not use a sugar solution of more than 50 percent concentration? A. Approximate—yes.

Q. And yet, as you just said, your application indicates that a 55% solution is satisfactory, doesn't it? A. You are using the word "indicates"—it was not intended.

Q. No, I say, indicates that a 55% solution is satisfactory? A. No, it doesn't indicate that it was satis-
97 factory. I disagree on that point. It indicates that
I have used in a spray process a 55, but I tried to make that correction as soon as I found it, that 52 was the limit.

Q. Here is what the application says, beginning at page 15:

> "Among sugar concentrations and kinds that I have found satisfactory for use in my process, are freezing solutions carrying the following:"

And No. 5 under that is:

> "A freezing solution carrying 55 percent total sugars solids consisting of approximately thirty-three percent levulose, and 22 percent of dextrose."

That is a statement that 55% is satisfactory, is it not? A. Yes. May I read my statement to the Board of Appeals regarding that statement? Would that be allowed?

Q. If you care to. A. It was typed. Is this the complete case, Mr. Brown?

Mr. Brown. Yes.

A. The second decision. Here it is, right here. Here is what I said, on page 4 of my request for reconsideration:

"Solution No. 5 in the solution examples, on page 16 of
applicant's description, is a mistake in the manu-
98 script. How 55 could have been retained when it is
contrary to all the findings of the disclosure is unknown except that it was originally a typographical error not seen because it came under example 5 and subsequently led to correcting of the figures to add up to 55%. No matter what the reason for example No. 5 on page 16 stating 55%, it should only state 52% and have its constituents lowered to hold their proportions. It would be proper for the Board to "discover" that the patent can be granted when this is done."

That's the best I can do for you, sir. I did make a mistake, and I am not claiming it. I made a mistake. I will delete it at any time.

By Mr. Reynolds:

Q. You have not amended the application to eliminate it though as yet, have you? A. Can we amend the application at the present time?

Mr. Brown. It has not been amended so far as I know. The case was out of the examiner's hands when that discovery was made.

The Witness. I would amend it today if I had that privilege.

By Mr. Reynolds:

Q. Assuming it should be 52%, that is still higher than
the 50% which you testified was the limit, is it not?
99 A. Yes, it is, but it is a specialized case where the
products are handled in a specialized way. That's all I can answer you, sir, and I have not claimed in that example a product that is undepleted entirely osmotically. I have shown by that example that there is a substance coming out of the berries, and it dilutes the solution, whereby I have to fill it up again to make those special "show" berries.

That example was a little experiment that was conducted in a small machine to make some berries that were covered with pectin and other things, to make some classic examples, and I liked them so well I put that in. At the present moment I am sorry I put it in, sir.

Q. Is your process being used commercially at the present time? A. My process was filed in November 1939, when the war had already started in Europe. I used my process commercially in the spring of 1940 under a special consideration, and some product was made, but since that time most of my time has been given to the defense efforts, first at Pickadinny Arsenal and then in the chemical warfare service as a mechanical and chemical engineer, then with the Ordnance Department as an industrial engineer, and when I went back this last year my finances were so that I could get my attorneys and do the things I wanted to do
in 1939 and 1940. I found that priorities and so forth
100 would not allow us to start a new company and get
our equipment, so we are looking for the opportunity
to put it in practice.

Mr. Reynolds. That is all.

The Court. Step down.

(Witness excused.)

Mr. Reynolds. That is all?

Mr. Brown. That is all, yes.

(Plaintiff rests.)

(Thereupon, the defendant, to maintain the issues on his part to be maintained, offered the following evidence:)

Defendant's Evidence

Mr. Reynolds. I would like to offer the defendant's exhibit, consisting of copies of the Zarotschenzeff and Taylor patents and copies of the examiner's statement and the decisions of the Board of Appeals.

The Court. Very well, that will be admitted in evidence as defendant's exhibit No. 1.

(The document referred to was marked as defendant's exhibit No. 1, and was received in evidence.)

(Defendant rests.)

The above and foregoing, plus the further testimony given during the concluding arguments, by the plaintiff, comprise all of the evidence offered and received upon said hearing.

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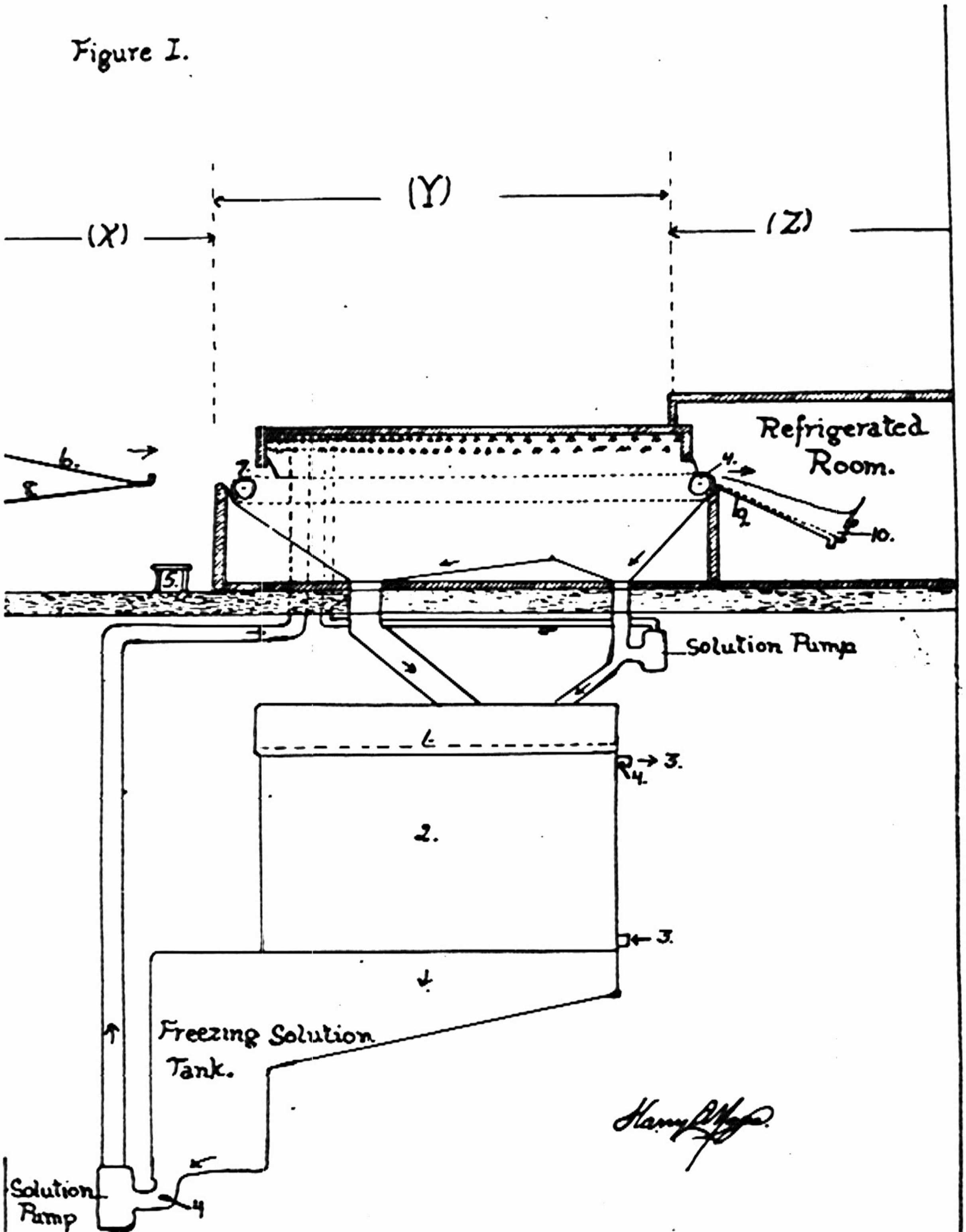
III.

EXHIBITS.

Excerpts from Plaintiff's Exhibit No. 1.

Figure I.



123 *Freezing Comestibles with Compatible Solutions.*

My invention relates, broadly, speaking, to the freezing of fruits, berries and other edible products by the use of solutions of water soluble constituents of the same, particularly by the use of solutions containing their juices and water reinforced by sugars normally occurring in comestibles.

Methods of freezing comestibles with appeciable to extensive alterations in their composition, structure, colors, flavor etc are numerous. Variations in the manner in which heat is extracted to carry out the freezing operation include a number of procedures which have been followed with results which, to many not well versed in the many arts related to foods, appear to be retaining desired properties.

It is quite universally recognized that cooking, treating with liquids at widely different temperatures than the comestibles, drying etc change the structure, color, properties, flavor, uses etc of comestibles. Products resulting after any of the above treatments are not "natural"—as in their living state— and the changes are readily recognized as, for example, the differences between scalded and raw milk, the difference between fresh and canned pineapple, the differences between raisins and fresh grapes, the differences between canned and fresh peaches and the differences between the color of fresh Concord grapes and many products made from them.

Progressive endeavors to preserve "Nature's" productions with their "natural" consistencies, structures, colors, flavors etc and to bring about a wider appreciation of distinctive products, by sweetening, adjusting acid or blending with other flavors, have led to an appreciation of an increasing number of factors that are fundamental in sev-
eral arts as, for example, improvement in the variety
124 or species, improvements in yields and quality by
fertilization and pruning, changes produced by cli-
matic differences, jam and preserve manufacturing, fruit

juice preservation, vacuum instead of open kettle cooking, jell and pectin studies, confectionery manufacture.

As the volume of frozen foodstuffs has rapidly increased and as methods of freezing have multiplied, I have failed to find many frozen products having "natural" characteristics, structures, colors, flavors etc and have observed that, in general, prevailing freezing methods do not improve—on the whole—in "natural" characteristics over products that can be produced by methods of processing having no freezing step.

The opportunity to shorten the temperature difference between the freezing point of water and the temperature of the freezing agent necessary to produce "quick frozen" comestibles should give a process for producing more "natural" preserved foodstuffs was my deduction: I made it my objective.

Another objective is a "quick" freezing process that allows the holding of "Nature's" productions in a solidified form—that maintains the "natural"—until the time when they are desired either for uses depending on the presence of "natural" characteristics or the presence of the "natural" characteristics as a starting point from which to produce other quality products.

My present invention attains the desired goals because I have discovered how to employ heat extraction with special consideration and control of hithertofore uncontrolled factors. Such an invention is more than applications of heat extraction by usual refrigeration practices. Each part and cell of a comestible has—in its "natural" state—, a composition, a structure and a relation to other cells and parts of the comestible that are based on species, variety, growth, life processes etc of the particular comestible. My frozen products are "natural" because the "quick" freezing is carried out without appreciably altering these relationships.

* * * * * * * * * *

126 The specific gravities of the comestibles are much less than those of the freezing solutions. These give specific problems to solve in connection with the "immersion" freezing procedures for comestibles. I have noted that small fruits etc will float partially out of the immersion freezing solutions and that there are cases where comestibles below the surface buoy up the top layer so that it is practically out of the freezing solution. Also, I find that certain devices, used to hold the comestibles down under the freezing solution, suppress the flow of the refrigerant on the surfaces of the comestibles next to the restraining surfaces. I find that the volume of liquid that could reasonably be designated as a "fog spray" is inadequate to take the desired amount of heat away from the comestible surfaces in sufficiently short time.

I find, by actual test, with a free flowing refrigerant, that, if the sprayed or poured volume of freezing solution is ample per unit of surface, there is very quick freezing of the treated surface providing the freezing solution is over or a necessary differential in temperature below the freezing point of the comestibles. The freezing takes place before any appreciable withdrawal of liquid from the comestibles by osmotic action. Frozen products carry a film of liquid brine on their surfaces at the end of the freezing processes which is small in amount—after draining off—in a place held at, for example, plus twenty degrees Fahrenheit. The remaining film obeys the laws governing solutions and therefore acts in no abnormal way when it causes a dissipation of the frozen state, in proportion to the amount present, and penetrates the frozen comestibles while the same are stored at temperatures above the eutectic point of the brine solution.

* * * * * * * * * *

127 The liquid freezing agents which are the regular means of heat transfer from the comestibles, in my invention, are of fruit or other comestible constituents—principally added sugar or sugars in solution. They, as

brine, can have an osmotic action on the comestibles but they are compatible in larger quantities than the brine. It is important not to allow compatibility to mislead where there is perhaps a large withdrawal of solution from the comestibles by osmotic action. All these sugar freezing solutions are of higher viscosities than the brine solutions having the same freezing point. Osmotic action can be increased by higher vicosities because the slower movement of the thicker solution gives more time on or near the surfaces of the comestibles. Osmotic pressure of sugar solutions, that I use, runs up to a hundred or more atmospheres in many cases. A few degrees change in temperature of concentrated sugar solutions may be accompanied by what, to those uninitiated, are unbelievable changes in viscosity. The marked increases in viscosity, as saturation of a very soluble sugar is approached, can prevent the necessary rates of heat transfer from comestible surfaces for an effective operation of "quick" freezing. Colloidal materials from comestibles (pectin etc) have marked tendencies to increase viscosities and can induce jellations as the temperatures are lowered. It is therefore a part of my invention to have found conditions in which solutions containing fruit constituents and sugars can be economically and advantageously employed as direct freezing agents.

• • • • • • • • • •

128 It has already been brought out with the brine, which is free flowing, that improper products may result if the volume of freezing solution is not great enough to maintain the temperatures of the surfaces of the comestibles below the freezing point thereof. Since increased viscosity goes with lowered temperatures of a given solution it has been necessary to study the properties of the sugars that can be used and to know these in respect to one another, mixtures, other substances present etc. In this connection, I have found that I am working in a field where the literature and artisan information are very scarce and often misleading.

There are advantage in sugar mixtures as they can be employed as freezing agents in preserving the "natural" states of comestibles without affecting adversely the properties of the comestibles. Both low enough viscosities and temperatures may be economically maintained, providing the freezing equipment is built for the purposes of the process instead of along lines that are divergent as, for example, those of standard storage warehouse refrigeration technic. Specific sugars in the mixtures, moreover, have advantages due to specific actions of the sugar film remaining on the frozen products while they are in frozen storage.

* * * * * * * * * *

129 A fruit juice by itself would have practically the same, if not the same, freezing point as the comestible from which it came. Freezing to produce "natural" frozen products by what are usually meant by the term fruit juices is therefore not feasible. As to the use of fruit juices and other comestible concentrates as freezing agents, an adequate concentration of a fruit or other comestible juice, to lower the freezing point sufficiently for use, is regularly accompanied by the building up of too great a viscosity. It is possible to make usable solutions from fruit juices and other comestible extracts by concentration followed by other treatments but such concentrates are the result of processing that removes and changes constituents.

* * * * * * * * * *

130 I find that the above is contrary to fact when tried either under the directions given or on a technical basis. Water is a constituent of fruit juice and its concentration (percentage) is much greater in the fruit than in the freezing solutions to which "substances for lowering the freezing point" were added. The increased concentration of sugar, for example, in the refrigerating solution of itself causes osmotic action, pulling constituents, notably water, from the comestibles. When this happens the comestibles

shrink and are of changed physical and chemical compositions. (Five percent shrinkage in thickness of some comestibles has been found to be accompanied by around fifteen percent loss of weight.)

* * * * * * * * * *

132 It has been customarily considered, in the freezing arts, that a comestible lowers first in temperature to its freezing point (approximately) and then holds that temperature, while the latent heat of freezing is being withdrawn, after which the product lowers its temperature towards the freezing medium or storage room temperature. Under such conditions figures have been worked out for the percentage of the original water content that remains unfrozen at different temperatures below the freezing point. The amounts of water left are probably due to the formation of ice—smaller or larger crystals—depending on the rate of heat extraction, and the remaining concentrated liquids having lower freezing points.

A reference gives,—the heat conductivity of water as .0013 and ice as .0057. These figures are in the direction for confirmation of my discoveries that it is feasible to freeze the surfaces before the remainder of a sizable comestible has lowered to its freezing point. The solidified or jellied zone then advances inward progressively with little movement of liquid constituents from cell to cell. In each cell are, moreover, colloidal materials and these, under the rapid freezing technics of my process may produce a jellation, firming and subsequent lowering of the temperature to below the freezing point, without nearly the theoretical amount of heat necessary to solidify the water contained being extracted. Such products have "natural" characteristics to a greater extent than those that are frozen where the temperature lowers to the freezing point, holds until the latent heat of freezing is extracted and then lowers again.

In the foreoging discussions of the status of the food freezing arts, refrigerating solutions, use of sugars, characteristics of products produced etc, I have indicated fac-

tors on which my invention depends. They are—that freezing of comestibles to preserve their "natural"
133 state—is accomplished by flowing or spraying solutions over said comestibles under conditions which include,—one, the refrigerated solution at the temperature applied must be free flowing enough so that it can be replaced immediately by following solution before the liquid, next to the surfaces of the comestibles, has exerted appreciable osmotic action; two, the refrigerated freezing solution must be applied in such volume, per given surface, that its temperature is not raised sufficiently to prevent the maintenance of the other conditions prescribed; and three, the temperature of the solution must be low enough below the freezing point of the comestibles, so that under the above conditions, it freezes the surfaces of the comestibles before there is appreciable extraction of constituents from them. It is objective to have the surfaces of the comestibles give up heat to the freezing solution—to the full extent the frozen surface (or original surface) can—at the temperature differentials employed.

* * * * * * * * * *

135 To illustrate the properties of sugar solutions with respect to viscosity relations to temperatures Tables I and II have been prepared. The tests were on sugar solutions as they would be ordinarily met in commercial practices.

TABLE I. SUCROSE (COMMERCIAL GRADE).

Absolute viscosity in centipoises (approx.)

				Increase in viscosity over			
			50%	Over 70 degrees F.		For last 10 degrees lowering	
Temp. F.	40%	50%	over 40%	40%	50%	40%	50%
70	6	14	8				
65	7	17	10	1	3		
60	8—	19	11+	2—	5	2—	5
55	8+	22	14+	2+	8	1	5
50	9	26	17	3	12	1+	6—
45	10	29	19	4	15	2—	5+
40	11	33	22	5	19	2	5
35	12+	38	26—	6+	24	2+	9
30	14	44	30	8	30	3	11
25	17	50	33	11	36	5—	12
20	froz.	58			44		14
15	"	froz.					

TABLE II. "INVERT" SUGAR (WHITE PASTE GRADE)

Temp. F.	Absolute viscosity in centipoises (approx.)				Increase in viscosity over—											
	40%	45%	50%	55%	45%	50% over	55%	Over 70 degrees F.				For last 10 degrees lowering			
					40%	40%	45%	40%	45%	50%	55%	40%	45%	50%	55%
70	4	7	11+	20	3	7+	13								
65	5	8	13	23	3	8	15	1	1	1+	3				
60	6	9+	14+	27	3+	8+	18—	2	2+	3	7	2	2+	3	7
55	7	11	17	32	4	10	21	3	4	6—	12	2	3	4	9
50	8	13—	19	38	4+	11	25+	4	6—	8—	18	2	3	5—	11
45	9—	14	22+	45	5+	13+	31	5—	7	11	25	2—	3	5+	13
40	10—	16	26	55	6+	16+	39	6—	9	15—	35	2—	3+	7	17
35	11+	18	30+	66	7—	19	48	7+	11	19	46	3—	4	8	21
30	13—	21	37	80	8+	24+	59	9—	14	26—	60	3	5	11	25
25	14	25	44	98	11	30	73	10	18	33—	78	3—	7	14—	32
20	22	29	52	128	7	30	99	18	22	41—	108	9—	8	15	48
15	fr	35	64						28	53—			10	20	
10	fr	fr	77							66—				25	
5	fr	fr	fr												

136 I do not limit myself to any specific sugars as in spite of the solubilities of some sugars being too low to allow the necessary freezing point depressions, they may be present in some quantities if compatible with the comestibles being frozen. Sucrose, "invert" sugar and dextrose are the sugars of commerce that I find most readily available. They define as follows;—sucrose is ordinary cane or beet sugar; dextrose is glucose or "cerelose" (an anhydrous crystalline form); and "invert"—in the strict sense—is a mixture of equal proportions of dextrose and levulose resulting from the hydrolyzing of sucrose.

I have discovered that the "absolute" viscosity of solutions at the temperatures employed in freezing comestibles according to my invention is less than approximately seventy centipoises. I use, as a rule, solutions falling between about forty and about sixty centipoises, absolute, viscosity at the temperatures used. Pectins, gums etc from the comestibles may raise the viscosities above the figures given in Tables I and II. It is evident that the flow of the higher (above my limit) viscosity solutions on the surfaces of the comestibles is not enough and the expenses of pumping and distributing such solutions are higher.

Consideration, both as to freezing the comestibles and handling the freezing solutions, have led to establishing a

preference for those mixtures which will have the lower viscosities and yet produce the required freezing point of water depression. In a solution, of a given concentration, the freezing point depression is directly related to the molecular weights of the sugars in solution. The hexose sugars, dextrose and levulose, therefore are more desirable than the disacharides of which sucrose is the most commonly used. Dextrose and levulose are not interchangeable in making freezing solutions for dextrose is not sufficiently soluble to give low enough freezing point depressions by itself alone. It is well known that when a solution has considerable of one sugar dissolved in it, it will still dis-
137 solve enough of another soluble sugar so that the
total sugar concentration is greater than if only one sugar was present. It is likewise known that, as the saturation point of one sugar is reached, the presence of another sugar may change its solubility. This along with the lower solubility of dextrose makes it possible to cool and treat a concentrated "invert" sugar solution so that part of the dextrose comes out along with water etc. leaving a solution that carries much more of the more soluble levulose than the less soluble dextrose. (The solution portion of fully "inverted commercial pastes" may be such a composition.) The higher concentration of total sugars, thus possible, in a low temperature freezing solution, makes it possible to have usable viscosities at lower temperatures than can be had with "invert" sugar solutions having equal or slightly more dextrose than levulose. These lower temperatures may be desirable when freezing comestibles having the lower freezing points or tendencies to supercool, as otherwise, the temperature difference between the freezing point of the comestible and the freezing solution may not be great enough to produce the high quality "natural" frozen products desired. Using the lower temperatures, however, makes the weight of comestibles (as expressed in heat extraction units) frozen by a primary refrigeration machine a smaller percent of its "rated" capacity than is

the case if higher temperatures will do the freezing. In the majority of cases I do not find it necessary to have the lower temperatures that are only possible with levulose or high levulose solutions.

Among sugar concentrations and kinds that I have found satisfactory for use in my process, are freezing solutions carrying the following:

No. 1. Fully inverted sucrose diluted to approximately fifty percent total sugars content by weight and used in freezing comestibles until its sugar content has been reduced by comestible extracts and water two, three, five etc
per cent—depending on the comestible being frozen.
138 "Invert" sugar solutions at concentrations that give
soluble solids concentrations of from forty-four to
fifty-one percent, by refractometer, when the comestible extracts are included and covered.

No. 2. An "invert" sugar solution carrying from forty five to forty seven percent total sugars content along with a little sucrose and fruit acid. (This is what No. 1 can become when diluted with certain fruit juices.)

No. 3. A solution made by taking three parts of regular "invert" sugar by weight to one part of a commercial invert sugar syrup of the same concentration but only two thirds inverted. This mixture is diluted to just under fifty percent total sugar solids and has, in the freezing equipment, both a slightly higher freezing point and viscosity than the pure "invert" of equal total sugars content. In use this solution picks up comestible extracts and is reinformed from time to time by the same mixture.

No. 4. A freezing solution consisting of approximately twenty three percent dextrose, twenty percent levulose, six percent sucrose and fifty one percent water. The same solution as the result of using No. 1.

No. 5. A freezing solution carrying 55 percent total sugars solids consisting of approximately thirty three percent levulose, and 22 percent of dextrose. This carrying fruit juices after continued use and concentration by freezing out water.

No. 6. The same as No. 5, but carrying a little sucrose, in addition to or with the total sugars content cut down by the sucrose substitution for hexose sugars.

No. 7. Levulose; in use this becomes a very high levulose freezing solution.

* * * * * * * * * *

142 When a freezing solution in the viscosity ranges of my invention, is being circulated at approximately as low a temperature as possible—without forming ice—there is a tendency for ice to be formed on the surface of the comestible at first contact between the freezing solution and the comestible to be frozen. This has been observed to be an advantage. The dilution that is constantly going on, is also a pressure towards more "natural" frozen products through ice being the first solid that will come out of the solution.

* * * * * * * * * *

143 Two points in regard to heat transfer stand out;—(1) the moving liquid on the surface of a comestible is one of the most rapid heat transfer agents and (2) the frozen layer of the comestible, under the moving freezing solution, is a more rapid conductor (heat transfer agent) than unfrozen comestible. The objective is to get the frozen layer started as soon as possible. This is why I prefer solutions that, on cooling, will separate ice first and use them in such volumes that they are not raised enough in temperature to hinder the formation of the solid layer, at the comestible's surfaces.

In my invention the hindering effects of the usual almost stationary liquid film, that is right next to an "immersed" object are partially done away with. I spray the freezing medium in quantity from the top and sides in amounts greater than those required to cover the comestibles with a liquid film and this, together with the force of gravity, increases the "wiping" action of the freezing solution on the surfaces of the comestibles. The spraying can not be

said to change straight line to turbulent flow but liquid particles added here and there on the moving liquid
144 on the surfaces cause increased "wiping" and increased motion of the freezing solution. The specific gravity of the freezing solution is enough higher than that of the water or comestible extracts, on the surfaces of the comestibles—when they go into the freezing chamber—, to increase contacts with the actual surfaces of the comestibles, expediting the quick formation of a solid layer at the comestibles' surfaces.

* * * * * * * * * *

145 Figure I is a diagramatic sketch only. It does not include details (the representation of the sprays coming from the top and angled in from the sides is, for example, not overclear). My invention, proper, deals with what happens in the longitudinal division of Figure I labeled (Y). (X) deals with the comestibles until they are placed in the freezing chamber and (Z) is the start of the handling of the frozen products which may go on through storage, distribution etc. over a period of several months.

Section (Y) illustrates a belt freezer consisting in part of,—an insulated tunnel carrying an endless belt, a solution distributing system of pipes, nozzles etc and a means of conveying the freezing solution back for recooling. Below the freezing tunnel is an insulated room where such items as the solution filter (1), heat exchanger (2), freezing solution tank, solution pumps etc are located. Connections labeled (3) are for connecting the heat exchanger with the primary source of refrigeration and its regulating devices.
Points labeled (4) simply indicate that there are
146 controls for maintaining the temperature of the primary refrigerant, the refrigerating (freezing) solution, the movement of the comestible conveying belt etc.

Section (X) of Figure I. Here it is indicated that an operator stands on (5), takes containers of prepared comestibles from (6), places them on the freezer belt at (7) and sends back the empty receptacles on (8).

Section (Z) of Figure I. As far as shown here, this is an insulated refrigerated room,—with only a part of the equipment indicated. The frozen comestibles drop onto screen (9) and collect in hopper (10) while continuing to drain. The temperature of the room is maintained below the freezing point of the comestibles, for example, at plus twenty two to twenty five degrees Fahrenheit. From the hopper on, the operations are the handling of the frozen product, not its freezing.

In starting a freezing operation with the solution already in the tank, the pumps are turned on and the solution circulated. The controls on the primary refrigeration are set at a point above where the primary refrigerant will freeze ice from the freezing solution onto the coils. The comestibles are put into the freezing chamber and the circulating freezing solution extracts heat from them and returns to the heat exchanger where it is recooled. When a full freezing load is in the freezing chamber it may be possible to lower the temperature of the primary refrigerant a little more. The returning solution is shown in Figure I as being divided in the bottom of the freezing tunnel. A separate pump is placed there to send solution (part from end of tunnel that is safety zone) back up, if desired, without going with the main amount to the heat exchanger. This is in line with the comestibles being able to use a larger amount of solution as they go into the freezing chamber. It is important that the freezing solution be circulated in volume enough so that the returning solution is not raised over a very few degrees over the temperature to which it was cooled by the heat exchanger.

147 The freezing solution is in reality a mixture of the sugars and comestible extracts just as soon as the extracts on the surface of the comestibles are added to the original solution. Experience shows an operator just about how long he can run without reinforcing with concentrated sugar or concentrated sugar and comestible extracts solutions. When the comestibles are cut fruits, that bleed

very readily, it is desirable to have the freezing solution held closer to the point at which it will form ice on dilution or cooling. The following are more specific examples of freezing according to my invention.

Strawberries. These are a fragile, perishable fruit of distinctive color and flavor that have no appreciable protective outside coating. They blemish and lose juices easily. The fruit is lower in pectins than many others. The soluble solids content varies with individual fruits but is relatively low-making the freezing point only a little below that of water.

(1) The selected berries are hulled, washed, drained and brought to the freezer which, for example, is circulating a refrigerating solution that is being sprayed at plus 16 degrees F. The particular composition contains fruit extracts but is in soluble solids content, essentially 23 percent dextrose, 22 percent levulose and two percent of comestible sources. The fruit is distributed on the freezing belt in layers up to three deep and the moving belt carries the berries along at the rate of around one foot per minute. Baffles are so placed that there is no spray hitting the fruit until it is the full volume of over three gallons per square foot of belt surface per minute. (In some cases the volume is four to six gallons per square foot of freezing belt surface per minute). The rate of application drops as the fruit moves along although it is maintained at practically the initial rate for about four minutes. When the fruit is about half way through the freezer the rate of freezing solution application may drop to 15 to 25 percent
148 of the initial rate. The fruit varies in size and this,
with unevenness of loading, calls for safety factors such as an extension of time under the sprays. Fruit arriving at (O) in about fifteen minutes has, as a rule, been in the freezing chamber over the minimum required time. The frozen fruit rattles down the incline into the hopper (H). It has a bright "natural" color, it is natural in shape and on cutting and examining found to have structure and other

"natural" characteristics preserved. It is coated with the freezing solution. From this point on it is handling a quality "quick" frozen product having "natural" characteristics.

The liquid on the berries as they went into the freezing chamber was both water and fruit juice. That was largely pushed off immediately into the freezing solution along with perhaps some more extracted liquid—the amount being less the more nearly I have instantaneous freezing at the surfaces of the comestibles. As soon as the freezing solution dilutes or has lowered appreciably in volume, it is brought back to strength and volume. The reinforcing may be carried out in one of a number of ways as,—the constant dropping in of a concentrated solution at an adjusted rate; by, at intervals, pouring a few gallons of a concentrate into a fast moving stream of the freezing solution as it is returning to the heat exchanger and yet, another way, which is always safe against causing any local precipitation of constituents by mixing the concentrate to be added with about an equal volume of solution from the system and pouring the mixture in slowly (The concentrate is at room temperature).

(2) A high levulose solution such as the one designated as No. 5 may be started with for freezing strawberries. This, for example, is where it is desired to make especial products from sorted berries of selected colors and sizes. To have as little water as possible go into the freezing solution, the fruit is washed, spread out and allowed to dry before being hulled. After hulling (capping) the
149 berries are placed in the freezing chamber. The berries are loaded up to three deep and run through the freezing apparatus as the (1) example except for being a shorter time in the freezing chamber. The temperature of the freezing solution is kept in a range of from a low of plus 7 degrees F. to plus 10 degrees F. Reinforcements of the freezing solution are made when the freezing solutions throws out solid on the heat exchanger at temperatures of

around 10 degrees F. The solution is reinforced by adding a more concentrated solution carrying the proportions of dextrose to levulose and by concentrating the weakened freezing solution by freezing out water as ice.

Another procedure with a high levulose solution,—Instead of maintaining the high levulose solution at a concentration great enough to be used in the temperature range with an upper limit of plus 10 degrees F. it is used more dilute and, for example, in a range of from a low of plus 10 degrees F. to a high of plus 14 degrees F. This solution has been run for many hours without becoming more than faint pink in color. The loading, applications of freezing solution etc were as just above.

(3) Ordinary field run strawberries after regular factory hulling, sorting, washing etc are frozen with an "invert" sugar and fruit juice freezing solution carrying a little sucrose. The temperature employed for freezing was in the range of from plus 12 degrees F. to plus 14 degrees F. This solution was maintained at strengths such that it would throw out ice at approximately plus 11 degrees F. The loading, applications of solution etc approximate (1).

A note in regard to strawberries,—This fruit is frozen with solutions having viscosities below forty centipoises, absolute, applied in real volume per square foot of freezing belt surface at plus 18 degrees F. The compositions of the solutions are such that they throw out ice if cooled to a little below plus 17 degrees F. (Variations in the factors of temperature, viscosity and volume are of the nature that are made by the artists with sugars, acids and pectins in making fruit jellies).

* * * * * * * * * *

156 I have discussed and given illustrations of my in-
vention. To make the explanations and practices
157 clearer and more plain in relation to certain current
practices, I have gone into specific limitations and
failures in the prior art. In this connection it is repeated
again that I find that the freezing of comestibles, so as to

retain their "natural" characteristics, is much more than having available a source of low temperature refrigeration. Freezing has to be accomplished speedily enough so that the comestibles are not subjected to changes produced by osmosis, etc. I have pointed out why, perhaps, certain "immersion" processes as developed did not accomplish the desired end. I have indicated that amounts of solution in contact with the surfaces and rates of movement are much greater than can come under a "fog" classification of spray; if the fruits, etc. are to be frozen quickly enough so as to retain the natural properties.

It is my discovery and reduction to practice; that more important than lower temperatures with attendant higher viscosities and slow flow of the refrigerants on the surfaces of the comestibles, is high velocity (comparatively) of the freezing solutions on the surfaces of the comestibles once a necessary differential below the freezing point of the comestibles exists in the freezing solution.

I have not gone into detail concerning the many points that are concerned with quality in preserving a comestible after it has been frozen so as to retain its "natural" structure, composition, etc. The handling after freezing is not the freezing operation.

It is to be understood that my invention is not limited to the specific products, apparatus and treating materials described herein above, but is susceptible to various modifications and changes.

* * * * * * * * * *

177 Mail Division, U. S. Patent Office, Mar. 4, 1941.

Paper No. 10, Division 63, Mar. 5, 1941.

IN THE UNITED STATES PATENT OFFICE.

Applicant: Harry A. Noyes
Serial No. 304,954 Division 63.
Filed November 17, 1939. Room 4888.

For. FREEZING COMESTIBLES WITH COMPATIBLE SOLUTIONS.

Hon. Commissioner of Patents,
Washington, D. C.

Sir;

Herewith are Exhibits A, B and C to go with my amendment on this application filed (sent) under a dating of February 24, 1941.

Respectfully yours,

HARRY A. NOYES

---

178 Westfield Planters, Co-operative Fruit Products, Inc., packers of Ellen Clare, Westfield Maid Brands.
Westfield, N. Y.

February 2, 1939

Harry Alfred Noyes
367 Woodward Street
Waban, Mass.

Dear Prof:

I returned from the National Canners Convention in Chicago on Monday, the 30th, and was very happily surprised on my return to find your letter of January 20. I'll bet that you are happy to know that you are finally free from all obligation to do further work for the "Z" Pack. I guess we are finally free from them also, although we have been corresponding and fighting back continually ever since the machine left here last summer.

Here at the plant were are intensely interested in going ahead with the freezing of small fruits. However, we do not want a repetition of the last seasons experiment and I would welcome any suggestions you might have as to how we could continue work along this line and at the same time avoid the pitfalls which are so evident to both yourself and myself. I might also add that we are contemplating the installation of a new cold storage freezer for storing Grape Juice in bulk. This will, of course, necessitate the installation of cooling equipment to cool the juice from the presses as well as cold storage tankage or cooperage and refrigeration to maintain the cold temperatures in the cold room. If there is anything along this line that would interest you or ADL perhaps there is some service that can be rendered which will be mutually beneficial.

179 I am in the process of contacting York, Frick, and Vilter, as well as Crown Cork & Seal and Armstrong in regard to this installation. If there is anything in that that would interest you, I would be very happy to hear from you.

I want to apologize to you for not having written to you sooner but I want you to know that we hold you absolutely blameless for the unsatisfactory results of the portable machine here last year. It is a miracle to me and a great wonder to all of us, the patience which you exercised under such a tremendous strain and under such adverse circumstances as you encountered here. It was an object lesson in self-control to all of us and we feel nothing but the best toward you, and for you.

It was a real pleasure to have you with us and we hope that it will be duplicated sometime again.

Sincerely,

Westfield Planters Cooperative
Fruit Products, Inc.
TED SKINNER,
Ted Skinner
Executive Secretary and Treasurer

TRS:KG
DICT 2/1/39

180 Cherry Growers Packing Co. Co-operative
Traverse City, Mich.

February 23, 1939

Dr. Harry Alfred Noyes,
367 Woodward Street,
Waban, Massachusetts.

Dear Dr. Noyes:

Your letter of the 4th was very welcome and also I was interested in your article on the trend of quick-freezing.

I have not had any more negotiations with the Z Pak people. We did have T. V. A. do some experimental work for us. They froze a couple of tons of sour cherries. We have submitted samples to the trade and there is a sort of watchful waiting process going on right now to see how the cherries keep. There unquestionably is a certain osmotic action going on which dilutes the sugar coating so that in freezing it destroys the protection which it is designed to give. I feel the whole situation is in the experimental stage and that the product must be very much better before it will displace the present commercial method of packing.

Sincerely yours,

A. J. ROGERS
General Manager

AJR:mh

Member National Canners Association

* * * * * * * * * *

207 Mailed June 17, 1942.
Div. 63, Room 271, Letter No. 22
Department of Commerce

UNITED STATES PATENT OFFICE

Richmond, Va.
Before the Board of Appeals.

In re: Application of Harry A. Noyes
Serial No. 304,954
Filed Nov. 17, 1939

For: FREEZING COMESTIBLES WITH COMPATIBLE SOLUTIONS.

Examiner's Statement.

This is an appeal from the rejection of claims 9, 18, 19, and 23 through 31, all the claims in the case.

The claims are:

Claim 9. As a commercial frozen product whole and cut comestibles having a composition identical, as to individual or pieces of comestible to the previous natural unfrozen state according to United States Food & Drug Administration standards of identity and carrying in addition on its surface frozen added sugar solution and comestible juices.

Claim 18. In a quick freezing spray process for freezing comestibles with virtually no loss in weight and change in structure by employing a water solution of comestible extractives and sugars as the freezing agent that has a viscosity of less than sixty-five centipoises at the temperature applied to carry out the freezing, the steps of applying and varying the amounts of the freezing solution applied as the freezing progresses so that the temperature of the freezing solution is not raised over two degrees Fahrenheit as it comes away from the comestibles at any stage in the freezing operation after the first minute and a half approximately.

Claim 19. In a quick freezing spray process for freezing comestibles with virtually no loss in weight and change in structure by employing a water solution of comestible extractives and sugars as the freezing agent that has a viscosity of less than sixty-five centipoises at the temperature applied to carry out the freezing, the steps of applying and varying the amounts of the freezing solution applied as the freezing progresses so that the temperature of the freezing solution is not raised over two degrees Fahrenheit as it comes away from the comestibles at any point in the freezing operation after approximately one and one half minutes in the freezing operations and
208 further having the temperature rise of the freezing solution taper off as freezing progresses to give a rise in temperature of the freezing solution of one half degree or less during the last third of the time the solution contacts the comestible in carrying out the freezing thereof.

Claim 23. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating a refrigerated sugar solution carrying comestible extracts and of not over approximately sixty-five centipoises viscosity to carry out the freezing of said comestible, by directing said refrigerant solution alternately over the cooling means to maintain temperatures not lower than approximately plus ten degrees Fahrenheit and higher than approximately plus twenty degrees Fahrenheit and over the comestible until said comestible is substantially frozen, said refrigerant solution being applied to the comestible by spraying the solution over the comestible in such volume that the temperature of said refrigerant solution does not rise over three degrees Fahrenheit in circulating from the cooling means over the comestible being frozen back to the cooling means.

Claim 24. The process of quick freezing comestibles cellularly and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating a refrigerant sugar solution carrying comestible extracts and having a viscosity of not over approximately sixty-five centipoises, at the temperature applied to carry out the freezing, alternately over cooling means maintaining the temperature between plus ten and plus twenty degrees Fahrenheit approximately and over the comestible until said comestible is substantially frozen, said refrigerant solution is applied by raining it over the comestible and is so freeflowing at the temperature rained over said comestible that it is immediately replaced on the comestible surfaces by following solution and said refrigerant solution is applied in great enough volume to the comestible being frozen so that its temperature is not raised over three degrees Fahrenheit in its cycle from the cooling means over the comestible being frozen and back to the cooling means.

Claim 25. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating alternately over a cooling means and the comestible until said comestible is substantially frozen a refrigerant solution of not over approximately sixty-five centipoises viscosity at the temperature applied to carry out the freezing, which falls within the temperature range from approximately plus ten to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry
209 out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surface by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen back to the cooling means.

Claim 26. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comcirculating alternately over a cooling means and over the comestible until said comestible is at least substantially frozen, a refrigerant solution of sodium chloride in water solution together with comestible extracts having a temperature as applied to carry out the freezing which falls within the temperature range from approximately plus ten to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen and back to the cooling means.

Claim 27. The process of quick freezing comestibles cytologically and as individual units virtually unchanged in chemical composition by the freezing operation comprising circulating alternately over a cooling means and the comestible until said comestible is substantially frozen, a refrigerant solution consisting of sugar and comestible constituents in water solution having a viscosity of not over approximately sixty-five centipoises at the temperature applied to carry out the freezing which falls within the temperature range from approximately plus ten degrees Fahrenheit to approximately plus twenty degrees Fahrenheit, when the temperature of the refrigerant solution as applied to the comestible to carry out the freezing of the same is not over approximately two degrees Fahrenheit above the temperature at which said refrigerant solution will separate ice on heat extraction, said refrigerant solution being applied to the comestible as a spray of physical properties such that it is rapidly and continuously replaced on the comestible surfaces by following solution and also said refrigerant solution is sprayed in great enough volume so that its temperature is not raised over approximately two degrees Fahrenheit in its cycling from the cooling means over the comestible being frozen and back to the cooling means.

Claim 28. In a quick freezing liquid contact spray process of freezing comestibles virtually without change in celular and individual units as to chemical composition the step consisting of spraying the comestibles to carry out the freezing thereof with a refrigerant solution of sugar and comestible constituents having a viscosity of not over approximately sixty-five centipoises as applied to carry out the freezing at temperatures not lower than plus ten degrees Fahrenheit approximately.

Claim 29. In a quick freezing spray process of freezing comestibles virtually without cellular and individual unit changes in chemical composition the step consisting of spraying the comestible to carry out the freezing thereof with a refrigerant solution of sugar and comestible extracts that has a temperature as used falling in the range of from a low of approximately plus ten degrees Fahrenheit to a high of approximately plus twenty degrees Fahrenheit and having a viscosity as employed to carry out the freezing of said comestible that falls in the range of from thirty to sixty-five centipoises approximately.

Claim 30. In a quick freezing liquid contact spray freezing process of freezing comestibles virtually without change in cellular and individual unit chemical composition by means of refrigerant solutions composed of sugar and comestible extracts the step consisting of maintaining the volume of refrigerant solution sprayed in carrying out the freezing of said comestible great enough so that there is always a large enough volume of refrigerant solution flowing over the comestible so that the temperature of said refrigerant solution is not raised over approximately two degrees Fahrenheit by heat extracted from the comestible being frozen.

Claim 31. As frozen products, frozen comestibles of the general morphological and cytological factors as illustrated by strawberries, cherries, cut fruits and shelled green peas that have been frozen both cellularly and as individual units without virtual change in chemical composition.

Subject Matter.

211 The alleged invention relates to the preservation of foodstuffs by freezing. It is applicant's object (as it is the object of all freezing processes) to retain in the frozen product all the "natural' properties of the comestible—flavor, structure, size, shape, etc. In order to accomplish this result, the product must be rapidly frozen in order to produce small ice crystals which do not alter the cell structure. In using liquid refrigerants, the conditions must be so regulated that rapid heat exchange can occur. Moreover, osmosis and loss of fluid from the products being frozen must be avoided. The lower the temperature of the refrigerating solution, the greater is the temperature differential between the product to be frozen and the refrigerant. A very low temperature would accordingly lead to rapid freezing except for the fact that the viscosity of the refrigerant increases rapidly with decrease in temperature. At high viscosities, the film of refrigerant around the food pieces is not readily replaced and heat exchange is accordingly slow. Applicant accordingly uses refrigerants at such temperatures that the best compromise is attained between temperature and viscosity. This refrigerant is passed over the food pieces in such volume that the temperature of the refrigerant does not rise appreciably during its contact with the food.

More specifically, and referring to the drawings, 2 is a tank of refrigerant solution. This is an aqueous sugar or salt solution containing the juices of the comestible. It is maintained between plus 10° and 20° Fahrenheit and is of a viscosity not over about 65 centipoises. Suitable sugars are invert sugar, levulose, mixtures of levulose and dextrose, and mixtures of any of these with sucrose.
212 This refrigerant is pumped, by pump 4, to the spray heads, and flows over the comestibles carried on the belt 7. The refrigerant is returned to the tank 2, which contains cooling coils to maintain it at the desired temperature. The refrigerant is applied in such volume that its temperature does not rise over 3 degrees. The foodstuff, as it leaves the refrigerating apparatus is coated with the refrigerant.

References:

Taylor	2,164,362	July 4, 1939
Zarotschenzeff	2,140,043	Dec. 13, 1938

Rejection of the Claims.

Claims 9 and 31 are directed to frozen products. Claim 31 recites nothing more than frozen foodstuffs unchanged in chemical composition. This claim is substantially anticipated by any frozen comestible. Moreover, since applicant's process of freezing is deemed lacking in novelty, the product must of necessity be old. Claim 31 defines an ideal product, and differs, if at all, in degree and not in kind from the frozen products of the prior art.

Claim 9 is directed to a frozen product carrying on its surface frozen sugar solution. Taylor, 2,164,362, discloses frozen food coated with refrigerants (line 74, page 2, column 1, to line 2, column 2).

Zarotschenzeff, page 1, column 1, lines 48 to 51, teaches that a crystalline or glass-like coating of the refrigerant (sugar solution) may form over the comestible. It is not thought that claim 9 is patentable over these disclosures.

The remaining claims are directed to the process, 213 and while they differ in phraseology, in some minor details, and somewhat in breadth, all are directed essentially to the process described supra and consisting of spraying over the comestibles in large volumes a refrigerant at a temperature between plus 10 and 20° F. and having a viscosity below about 65 centipoises. The temperature of the refrigerant is not permitted to rise more than 3° during the process. As refrigerants, sugar or salt solutions containing comestible juices are used.

This process is substantially anticipated by Taylor. The patentee teaches the freezing of foods by passing over them aqueous sugar solutions at a temperature between 0° and 10° F. It is pointed out that +10° F. is within the range recited in the claims on appeal. As indicated in example (1) on page 2 of the patent, he refrigerant was circulated at such a rate that the rise in temperature of the solution passing over the berries was less than 1° F. Since the patentee uses the same sugar solutions at the same temperature, the viscosity must be the same as recited in the claims. While a viscosity of 400 centipoises at 8° F. is disclosed, the viscosity would be much lower at a slightly higher temperature. The patent to Zarotschenzeff supplements the disclosure of Taylor. Zarotschenzeff discloses additional sugars and further teaches that the juices of the food may be used in the refrigerant. This patent moreover discloses the use of a spray.

For these reasons, it is submitted that the rejection of the claims should be affirmed.

Respectfully,

A. H. WINKELSTEIN,
Examiner.

* * * * * * * * * *

217 Mailed Oct. 13, 1942.
U. S. Patent Office, Board of Appeals.
Appeal No. 42, 367, Paper No. 26, MEM

IN THE UNITED STATES PATENT OFFICE

Before the Board of Appeals.
Ex parte Harry A. Noyes.

Application for patent filed November 17, 1937, Serial No. 304,954. Freezing Comestibles with Compatible Solutions.

Mr. Harry A. Noyes pro se.

Applicant has appealed from the action of the examiner finally rejecting claims 9, 18, 19, and 23 to 31, inclusive.

Claim 18 may be takan as an example and reads as follows:

18. In a quick freezing spray process for freezing comestibles with virtually no loss in weight and change in structure by employing a water solution of comestible extractives and sugar as the freezing agent that has a viscosity of less than sixty-five centipoises at the temperature applied to carry out the freezing, the steps of applying and varying the amounts of the freezing solution applied as the freezing progresses so that the temperature of the freezing solution is not raised over two degrees Fahrenheit as it comes away from the comestibles at any stage in the freezing operation after the first minute and a half approximately.

The references relied upon are:

Zarotschenzeff	2,140,043	Dec. 13, 1938
Taylor	2,164,362	July 4, 1939

218 The disclosure relates to the freezing of edible products by the use of solutions of water soluble constituents of these products, that is, solutions containing their juices and water reinforced by sugars normally occurring in comestibles. It is stated to be an object of ap-

plicant to provide a quick freezing process that maintains the natural characteristics of fruits and the like until a time when they are to be used. It is disclosed that articles of the type under consideration when exposed to the action of a liquid freezing agent are subjected to osmotic action which is very active until the surface of the comestibles are frozen. It is further disclosed that if the liquid freezing agent is free flowing and there is sufficient volume of the freezing agent per unit of surface of the articles sprayed or poured thereon there is very quick freezing of the treated surface provided the freezing solution is at a necessary differential in temperature below the freezing point of the comestibles. In this way the freezing is brought about before any appreciable withdrawal of liquid from the comestibles by osmotic action takes place.

The liquid freezing agents used by applicant are said to be of fruit or other comestible constituents, principally added sugar or sugars in solution. The specification states that a few degrees change in temperature of concentrated sugar solutions may be accompanied by substantial changes in viscosity, which can prevent the necessary rates of heat transfer from comestible surfaces for an effective operation of quick freezing. It is stated that colloidal materials from comestibles have such marked tendencies to increase viscosity that jellations may be induced as the temperatures are lowered and it is said to be a part
219 of applicant's invention to have found conditions in
which solutions containing fruit constituents and sugars can be economically employed as direct freezing agents. In order to be satisfactory freezing agents these solutions containing fruit or other comestible constituents and sugars must be free flowing.

The specification states at page 14 that absolute viscosity of solutions at the temperatures employed in freezing comstibles according to applicant is less than approximately 70 centipoises and that solutions falling between 40 and 60 centipoises at the temperatures used are utilized.

The examiner states that claim 31 recites nothing more than frozen foodstuffs unchanged in chemical composition and that this claim is anticipated by substantially any frozen comestible. He further states that claim 31 defines an ideal product, and differs, if at all, in degree and not in kind from the frozen products of the prior art.

Claim 9 is directed to a frozen product carrying on its surface frozen sugar solution, and the examiner states that the patents to Taylor and Zarotschenzeff disclose the product called for in claim 9 and claim 31. Appellant states that the examiner should be overruled on all except claim 9 so that it is inferred that applicant considers that claim 9 is unpatentable. It is believed that the examiner's position is proper with respect to claims 9 and 31. The other claims are directed to the process and have been rejected in view of the patent to Taylor.

It is stated that the process consists of spraying over the comestibles in large volumes a refrigerant at a temperature between 10 and 20° F. and having a viscosity below 65 centipoises; 220 that the temperature of the refrigerant does not rise over 3°, and that refrigerants comprising sugar or salt solutions containing comestible juices are used.

The examiner holds that this process is substantially anticipated by the patent to Taylor. The examiner points out that Taylor teaches the freezing of foods by passing over them aqueous sugar solutions at a temperature between 0° and 10° F., that the 10° F. is within the range recited in the appealed claims; and that as indicated in example 1, on page 2, of the patent the refrigerant is circulated at such a rate that the rise in temperature of the solution passing over the berries mentioned was less than 1° F. The examiner states that the patentees used the same sugar solutions at the same temperature and that therefore the viscosity must be the same as recited in the claims. The examiner states that while the viscosity of 400 centipoises at 8° F. is disclosed the viscosity would be much lower at a slightly higher temperature, and that the patent to Zarotschenzeff supplements the Taylor disclosure by disclosing additional sugars and teaches that the juices of the food may be used in the refrigerant.

It is also pointed out that this second patent discloses the use of a spray. Appellant indicates that the Taylor process involves immersion of the comestibles in the refrigerant and that he has filed an affidavit stating that the Taylor patent did not produce his product, and that this affidavit should have eliminated the Taylor reference. The affidavit referred to appears to consist chiefly of an assertion to the effect indicated by appellant but this does not 221 obviate the Taylor patent as a reference. It is not apparent that the Taylor patent mentions the immersion of the materials in his refrigerant or any other specific way of treating the same.

The examiner's statement with respect to the Taylor process disclosed appears to be accurate and the difference of applicant's process over that of the Taylor patent, in view of the secondary patent, appears to reside principally in the viscosity of the liquid added to the refrigerant. These claims are limited to about 65 centipoises in viscosity while the lowest viscosity mentioned in the patent to Taylor appears to be 400 centipoises, but it is to be noted that this is at a specified temperature of about 8° F. The main feature of the patent disclosure seems to be that the patentee used solutions of the same materials, for his refrigerant, as those disclosed by applicant; recognizes the advantage of rapidly circulating the liquid; and that the viscosity of the same will have a material effect upon the freezing of the materials. The patentee Taylor also points out that the viscosity and freezing points of invert sugar solutions may be lowered by removing a portion of the dextrose from the sugar. The patentee also recognizes the advantage of circulating the refrigerant with such rapidity that the drop in temperature of the solution is very low, in the specific example given, less than 1° F., so that it is considered that the mere limitation to specific viscosity amounts to no more than a difference in degree and not to a different and patentable process.

Applicant's brief has been carefully considered
222 but it is our view that the claims are not patentable
in view of the references and reasons given by the examiner.

For the reasons indicated the rejection is affirmed.

E. T. MORGAN,
Examiner-in-Chief

F. P. EDINBURG,
Examiner-in-Chief

C. H. SHAFFER,
Examiner-in-Chief

} Board of Appeals

October 13, 1942.
Mr. Harry A. Noyes,
Curtis Avenue,
Marlboro, Mass.

* * * * * * * * * *

231 Mailed Dec. 8, 1942.
U. S. Patent Office, Board of Appeals.
Appeal No. 42,367, Paper No. 28, MSP

IN THE UNITED STATES PATENT OFFICE

Before the Board of Appeals.
Ex parte Harry A. Noyes

Application for Patent filed November 17, 1939, Serial No. 304,954. Freezing Comestibles with Compatible Solutions.

Mr. Harry A. Noyes, pro.se.

On Request for Reconsideration.

Appellant has requested reconsideration of our decision dated October 13, 1942 with respect to claims 25, 26, 27 and 31. Reconsideration of these claims is requested on the ground that no specific action was made on these claims in the statement of the examiner or in the decision of the Board of Appeals.

Claim 25, for example, calls for circulating over a cooling means and the comestible a refrigerant solution of not over 65% centipoises viscosity at a temperature within the range of 10° to 20° F. The Taylor patent discloses that the refrigerant liquid should have relatively low viscosity at 0° to 10° F. This is understood to say that the
232 freezing solution of the patentee may be used at 10°
F. which is the minimum temperature specified in these claims. The patentee also discloses that the viscosities and freezing points of invert sugar solutions may be lowered by removing a portion of the dextrose which seems to indicate reversely that the viscosity and freezing points could be raised by the addition of dextrose. The point of similarity of the reference to the claim seems to be that the patentee discloses the carrying out of the freezing by directly contacting the food with a suitable rapidly circulated liquid maintained at a temperature above the optimum temperature and substantially below the freezing temperature of the food, in general, from 0° to 10° F.

The patent to Zarotschenzeff discloses that it is old to spray the freezing solution upon the material to be frozen and it is considered that it would not be patentable to spray the solution of Taylor, if desired.

Since we do not find claims 25, 26 and 27 patentable over the art, there would be nothing patentable in amending claim 31 to conform to these claims.

For the reasons given in our decision and herein, the rejection is affirmed.

E. T. MORGAN, *Examiner-in-Chief*	Board of Appeals
C. H. SHAFFER, *Examiner-in-Chief*	
F. J. PORTER, *Examiner-in-Chief*	

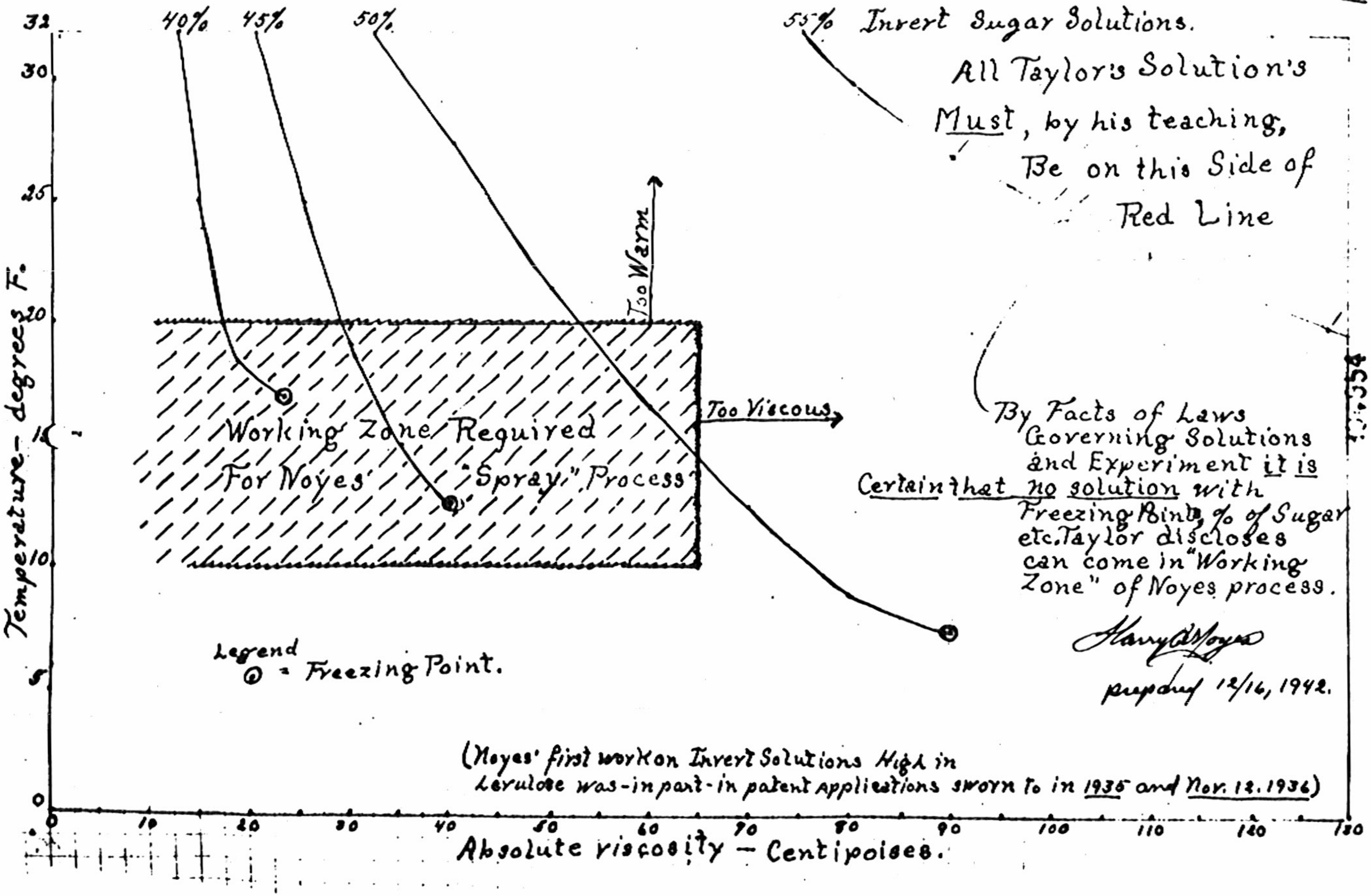
Substituting for Mr. Edinburg, deceased.

Mr. Harry A. Noyes,
Curtis Avenue,
Marlboro, Mass.
December 8, 1942.

* * * * * * * * * *

121

Temperature - Viscosity Relations of 40, 45, 50 + 55 % Invert Sugar Sols.



All Taylor's Solution's Must, by his teaching, Be on this Side of Red Line

By Facts of Laws Governing Solutions and Experiment it is Certain that no solution with Freezing Points, % of Sugar etc. Taylor discloses can come in "Working Zone" of Noyes process.

Harry A. Noyes

prepared 12/16, 1942.

(Noyes' first work on Invert Solutions High in Levulose was-in part-in patent applications sworn to in 1935 and Nov. 12. 1936)

Noyes vs. Cox
C.A. 20364

Pltff's 11(g)

FILED
JUN 17 1944
[illegible], Clerk

15. STORAGE CONDITIONS

Physical Properties

FRUITS and vegetables are alive and by virtue of that fact they carry on within themselves many of the processes characteristic of living things. For the long storage of many of these products low temperatures are necessary, tending to retard the deterioration which their life processes bring about, as well as decay due to bacteria or fungi. Refrigeration will not correct damage done by spoilage or mechanical injury prior to storage, which, however, is a common cause of controversy in connection with stored goods.

The subject of storage temperatures has been investigated by D. H. Rose and others of the Department of Agriculture,[1] whose recommendations are summarized in **Table 1.** Experience, as well as laboratory data, was relied upon for general recommendations. For most fruits and vegetables, a temperature close to 32°F. is given in this table, with a preferred relative humidity of about 85 per cent. Where these recommendations differ from those given by other investigators the fact is brought out for certain important products under subheads 5 to 40.

1. The temperatures recommended in Table 1 are the **optimum temperatures** for long storage. For short storage, higher temperatures can often be used satisfactorily. Conversely, products having a higher optimum can usually be held at lower temperatures for a short time without injury.

2. **Freezing point** determinations have been made and published on a large number of commodities.[2] The optimum storage temperature for many fruits and vegetables has been found to be just above their freezing point. Knowledge concerning these freezing points has therefore been of great benefit. For example, Emperor and Tokay grapes were formerly stored at about 34°F. When it was found that the freezing point of these grapes was below 27°, it became general practice to lower the storage temperature, thus prolonging the storage period about two months.

No values of either specific heat or latent heat are given, though some have been found and may be useful in computing refrigeration loads in special cases. There seems to be a close relationship between both of these properties and water content. See Woolrich et al[3] on latent heat of fruits and vegetables.

3. **Vital heat** is that evolved by the life processes of fruits and vegetables and is always accompanied by an evolution of carbon dioxide. It is very important in calculations involving the storage or shipment of fruits and vegetables that have not been precooled. This value is not known for many commodities nor very accurately for any. A few evaluations of the amount of heat given off by the respiration of stored goods are available[1,4] and are also given in **Table 2.**

4. **Water content** values of most fruits and vegetables are fairly well known and they are useful to the refrigerating engineer as a basis for calculating specific heats and the latent heat of freezing[3,5].

Chief Fruits and Vegetables

5. **Apples.** To insure soundness and good keeping quality, apples must be properly grown, and picked at the proper stage of maturity; must also be handled carefully at all stages of harvesting, packing and storage in order to prevent bruising, skin punctures and other mechanical injuries; should be stored at 31° to 32°F. as soon as possible after being picked. Use oiled wrappers or shredded oiled paper at time of packing, to prevent **scald.** This trouble is hard to control on Grimes Golden, Mammoth Black Twig and York Imperial, is worse on immature than on mature fruit, and worse on fruit from heavily irrigated trees than on that from trees receiving more moderate irrigation. **Blue mold rot** develops most often at skin breaks, and is not entirely checked even at 32°.

Table 1. Storage Properties of Foods

Commodity	Storage temperature, °F.	Relative humidity, per cent	Approximate storage life	Water content, per cent[6,7]	Average freezing point, °F.
Apples	30–32*	85–88	—*	84.1	28.4
Artichokes					
Globe				83.7	29.1
Jerusalem	31–32	90–95	2– 5 months	79.5	27.5
Asparagus	32	85–90	3– 4 weeks	93.0	29.8
Avocados	40–55*	85–90	—*	—	27.2
Bananas	—*	—*	—*	74.8	—*
Beans					
Green or snap	32–40	85–90	2– 4 weeks	88.9	29.7
Lima	32–40	85–90	2– 4 weeks	66.5	30.1
Beets					
Topped	32–35	95–98	1– 3 months	87.6	26.9
Bunch	32	95–98	10–14 days	—	—
Blackberries	31–32	80–85	7–10 days	85.3	28.9
Broccoli (Italian)	32–35	90–95	7–10 days	89.9	29.2
Brussels Sprouts	32–35	90–95	3– 4 weeks	—	—
Celeriac	32	95–98	3– 4 months	—	—
Cabbage	32	90–95	3– 4 months	92.4	31.2
Carrots					
Topped	32	95–98	4– 5 months	88.2	29.6
Bunch	32	85–90	10–14 days	—	—
Cauliflower	32	85–90	2– 3 weeks	91.7	30.1
Celery	31–32	90–95	2– 4 months	93.7	29.7
Cherries	31–32	80–85	10–14 days	83.0	—*
Coconut, milk	32–35	80–85	1– 2 months	95.2	30.4
Flesh	32–35	80–85	1– 2 months	46.3	25.5
Corn (sweet)	31–32	85–90	—*	73.9	29.0
Cranberries	36–40	85–90	1– 3 months	87.4	27.3
Cucumbers	45–50	80–85	10–14 days	96.1	30.5
Dates	—*	—	—	—	−4.1
Dried fruits	32–50	70–75	9–12 months	—	—
Eggplants	45–50	85–90	10 days	92.7	30.4
Endive	32	90–95	2– 3 weeks	93.3	30.9
Florists' stocks					
Fern (leaves)	32–45	90–95	2 weeks–4 months	—	23.6
Lilies, bulbs	35–40	85–90	6– 8 months	—	—
Lily-of-the-valley pips	28	85–90	4–12 months	—	—
Frozen-pack fruits	−10– 0	—	6–12 months	—	—
Frozen-pack vegetables	−10– 0	—	6–12 months	—	—
Garlic	32	70–75	6– 8 months	74.2	25.4
Grapefruit	—*	85–90	6– 8 weeks	88.8	28.4
Grapes					
European type	30–31	80–85	3– 6 months	81.6	24.9
American type	31–32	80–85	3– 8 weeks	81.9	27.5
Horse-radish	32	95–98	10–12 months	73.4	26.4
Leeks	32	90–95	1– 3 months	88.2	29.2
Lemons	55–58	90–85	1– 4 months	89.3	28.1
Lettuce	32	90–95	2– 3 weeks	94.8	31.2
Limes	45–48	85–90	6– 8 weeks	—	29.3
Melons					
Watermelons	36–40	75–85	2– 3 weeks	92.1	28.8
Muskmelons	32–34	75–78	7–10 days	92.8	28.5
Honey Dew and Honey Ball	36–38	75–85	2– 4 weeks	—	28.8
Casaba and Persian	36–40	75–85	4– 6 weeks	—	—
Mushrooms (cultivated)	32–35	80–85	2– 3 days	—	30.2
Nuts, pecans	32–50	65–75	8–12 months	3.2	19.6
English Walnuts	32–50	65–75	8–12 months	2.5	20.0
Onions and onion sets	32	70–75	6– 8 months	87.5	30.1
Oranges	32–34	85–90	8–10 weeks	87.2	—*
Parsnips	32	90–95	2– 4 months	78.6	28.9

Table 1. Storage Properties of Foods (*continued*)

Commodity	Storage temperature, °F.	Relative humidity, per cent	Approximate storage life	Water content, per cent	Average freezing point, °F.
Peaches	31–32	85–90	2– 4 weeks	86.9	29[illegible]
Pears					
Bartlett	29–30	85–90	45-90 days	83.5	—
Fall and winter varieties	30–31	85–90	—*	—	—
Peas (green)	32	85–90	1– 2 weeks	74.3	30.[illegible]
Peppers					
Sweet	32	85–90	4– 6 weeks	92.4	30.[illegible]
Chili (dry)	32–50	70–75	6– 9 months	—	—
Pineapples					
Mature green	50–60	85–90	3– 4 weeks	—	29.[illegible]
Ripe	40–45	85–90	2– 4 weeks	85.3	29.[illegible]
Plums (including prunes)	31–32	80–85	3– 8 weeks*	85.7	28.0
Potatoes	36–50	85–90	—*	77.8	28.[illegible]
Pumpkins	50–55	70–75	2– 6 months	90.5	30.[illegible]
Quinces	31–32	80–85	2– 3 months	85.3	28.1
Raspberries					
Black	31–32	80–85	7-10 days	80.7	28.8
Red	31–32	80–85	7-10 days	83.4	30.4
Rhubarb	32	90–95	2– 3 weeks	94.9	28.4
Squash (winter)	50–55	70–75	2– 6 months	90.4	29.3
Strawberries	31–32	80–85	7–10 days	90.0	29.9
Sweet potatoes	55–60	75–80	4– 6 months	68.5	28.4
Tomatoes					
Ripe	40–50	85–90	7-10 days	94.1	30.4
Mature green	55–70	85–90	3– 5 weeks	94.7	30.4
Turnips (including rutabagas)	32	95–98	4– 5 months	90.9	30.5

* See detailed notes in this chapter.

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Bitter-pit, caused by picking too early, is not to be confused with **cork** which develops in fruit when on the tree. **Internal breakdown,** characterized by a mealy brown condition of flesh, results from allowing fruit to become overripe before picking or from holding at too high a temperature. Chief symptom of severe freezing injury is soft watery condition extending deep into flesh; slight freezing injury is not easily distinguished from injury due to bruising or to incipient internal breakdown; watersoaked bruises are not a sure sign of freezing.

Handle frozen fruit carefully and as little as possible; thaw at 40° to 45°. Ripening proceeds twice as fast at 40° as at 32°. Use of 30° adds 25 per cent to storage period over 32°.

Table 3 is from Department of Agriculture findings giving the time required for various apple varieties to reach full eating-soft condition when picked at proper maturity and stored immediately at 32°F.

Safe storage periods from a commercial point of view are from two weeks to a month shorter than those given in Table 3.

Apples should not be stored in the same room with potatoes and other odoriferous vegetables because of the danger that they will absorb undesirable odors.

6. Asparagus loses much of its food value and therefore its saleability within a few hours after cutting unless kept at a relatively low temperature. If the bunches are placed on damp packing and stored at 32°F. immediately after cutting, this commodity should keep in good condition 3 to 4 weeks. If received at the storage plant after a long haul from a distant point of production, it should not be expected to keep longer than 3 to 6 days. At 32° to 35° the stalks will not increase in length as at higher temperatures.

7. Avocados. Investigations in California on the storage of avocados have shown that the best temperature for all varieties grown there except the Fuerte, is about 40°F. The Fuerte discolors internally at this temperature but holds up well at 45°.

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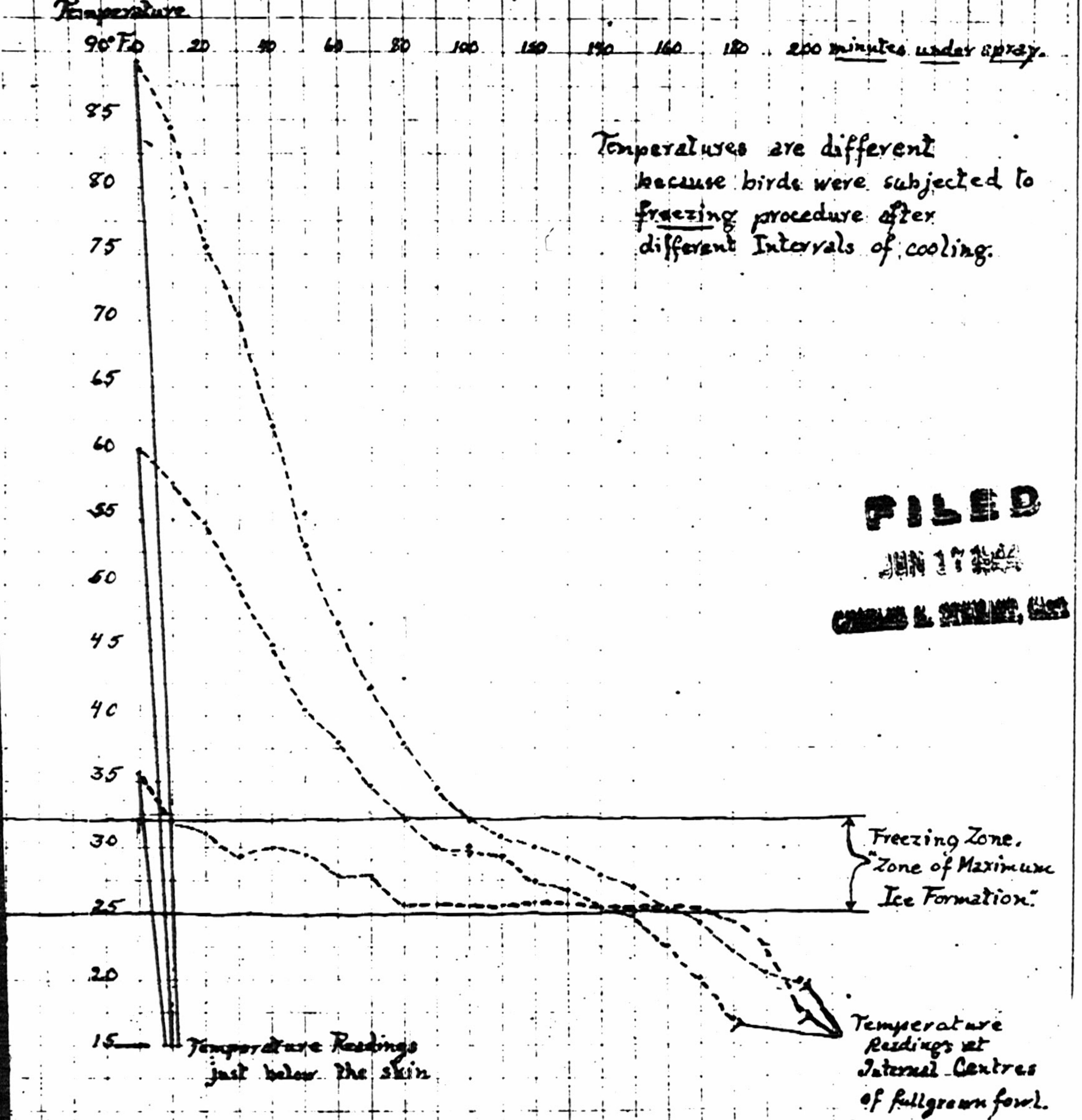
Pl'ff #8

"Quick" Freezing, Noyes Method on Fullgrown Fowl.



Temperatures are different because birds were subjected to freezing procedure after different Intervals of cooling.

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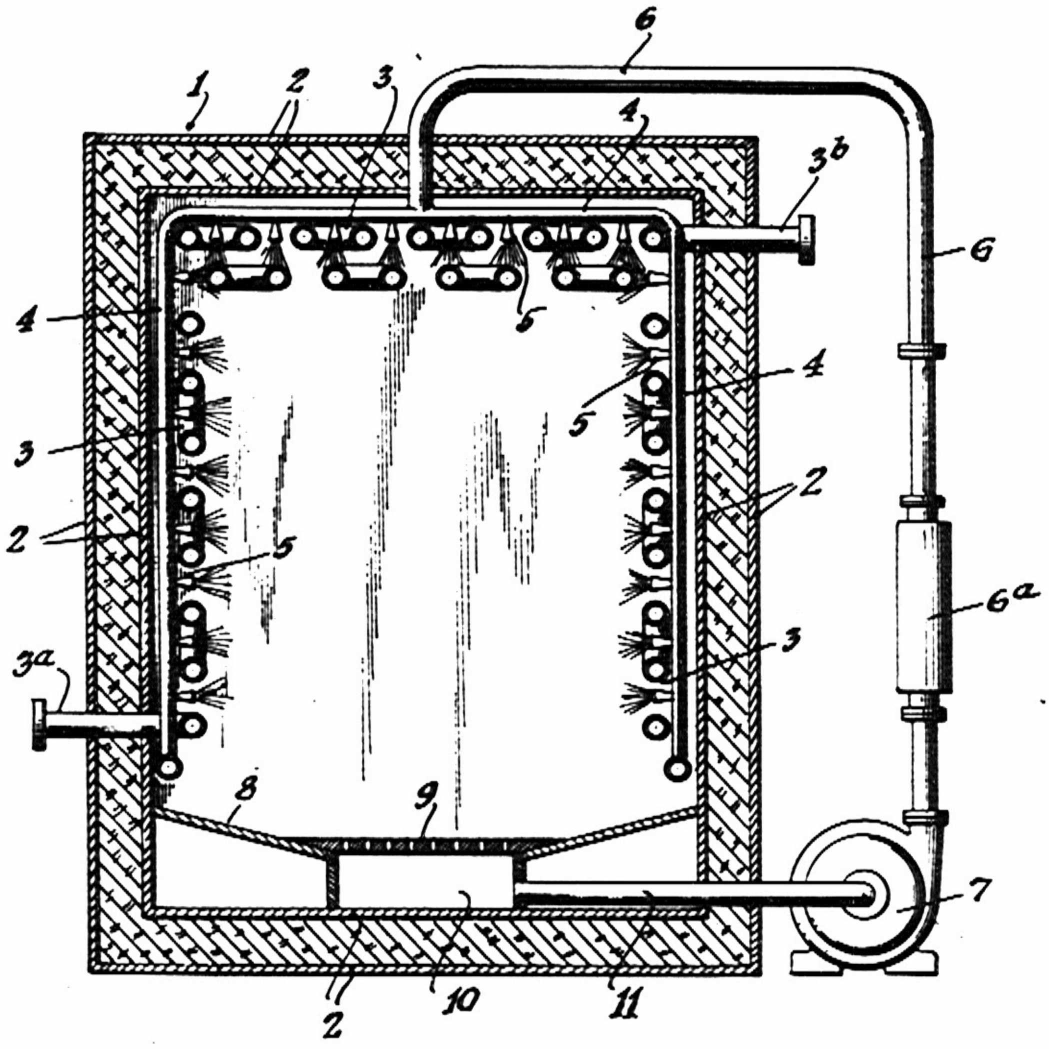
JUN 17 [illegible]
[illegible]

Data from three fowl same heredity, age, feeding etc.

Dec. 13, 1938. **M. T. ZAROTSCHENZEFF** 2,140,043

FREEZING WITH FRUIT JUICES

Filed Nov. 14, 1936



INVENTOR
Mikail T. Zarotschenzeff
BY
Hoguet, Neary & Campbell
HIS ATTORNEYS

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Patented Dec. 13, 1938

2,140,043

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JUN 17 1944
CHARLES E. STEWART, Clk

UNITED STATES PATENT OFFIC

2,140,043

FREEZING WITH FRUIT JUICES

Mikail T. Zarotschenzeff, New York, N. Y., assignor to Z Pack Corporation, a corporation of Delaware

Application November 14, 1936, Serial No. 110,786

2 Claims. (Cl. 99—198)

My invention relates broadly to the freezing of fruits, berries, vegetables and other edible products with natural or neutral refrigerated liquids and more particularly to the freezing of such products with sugar syrups or juices of the respective products.

The freezing of fruits and vegetables according to a well known procedure is effected by treatment with cold air. This method presents several serious disadvantages. For example, the product freezes rather slowly with the formation of large destructive crystals; drying and parching of the surface often occurs; the color changes and the edible qualities of the product depreciate materially.

Freezing of certain fruits, such as strawberries, in dry sugar has also been attempted but with unfavorable results. The dry sugar absorbs substantial amounts of the natural juices in the fruit leaving it deficient in this respect and therefore of inferior quality.

Another prior art process for freezing foods involves the use of salt brine. This process has definite inherent limitations since the brine is considered objectionable if not injurious to the edible qualities of the food and therefore special precautions are taken to minimize direct contact of the brine with the refrigerated product. Also, food refrigerated with brine must be thoroughly washed before consumption to insure removal of the brine.

In accordance with the improved method of my invention utilizing refrigerated liquids as the freezing agent, the above disadvantages are minimized, especially with regard to maintaining the natural edible qualities of the product. The neutral refrigerating liquids, such as sugar syrups, that I use are protective and not in any manner injurious to the natural desired properties of the product being refrigerated. They become a part of the edible product and do not have to be removed. The quick freezing with liquids, such as sugar syrups, produces a liquid coating over the product effecting homogeneous freezing throughout the fruit or other product and without causing any drying or shrinking. The liquid coating does not harden normally since its freezing or solidification point is below 32° F. The coating may become crystalline or glass-like if the previously frozen product is placed in cold storage for a considerable length of time.

One of the features of my invention is the use of natural or artificial juices, corresponding to the product to be frozen, as the refrigerating agent.

An object of my invention is to provide improved frozen edible products and processes for their manufacture, utilizing liquids as the refrigerating agent.

Another and more specific object of my invention is to freeze fruits and vegetables with a refrigerated liquid such as sugar syrup or juices obtained from or corresponding to the natural products.

The novel features of my invention are set forth with particularity in the appended claims. The inventive processes and products, however, will be clearly understood from a consideration of the following description taken in conjunction with the accompanying drawing, in which the single figure represents diagrammatically appropriate equipment for performing the freezing operations.

One of the principal ideas of my present invention is to freeze fruits, vegetables, etc. in a natural or neutral medium, such that the frozen product will not be affected adversely in any manner and upon thawing will reappear in substantially the same form as the original fruit before freezing. In other words, the fruit after being frozen and thawed will retain its original appearance, bloom, and other qualities.

The natural or neutral medium, which I employ in my freezing process, may consist of any syrup or liquid that will not contaminate the food being frozen and which has a sufficiently low freezing point, i. e., below 32° F. These syrups or other liquids may be prepared, of course, in any desirable combination. For example, sugar syrup may be made of solid sugar and water mixed in such proportions as to give the desired consistency to the syrup; or sugar syrup may be obtained commercially and diluted with water. Also, a mixture of sugar with glucose and other sugar derivatives may be used.

While my process is adaptable broadly to the use of various liquids, syrups or sugar solutions that are practically inert to the product being frozen, I have found it advantageous in several instances to use the natural juices of the product being frozen as the freezing agent or medium. For example, when freezing strawberries, the freezing liquid would be strawberry juice, and in the case of cherries, cherry juice would be used. By using the natural juices from these fruits as a refrigerating medium, the frozen fruit cannot have its flavor or taste adversely affected.

I have also found it advantageous when using fruit juices as a refrigerating medium to add to such juices a substance that will lower the freez-

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CHARLES B. STEWART,

ing point of the juices. For example, I may employ sugar, alcohol, glycerine, or other such suitable agents which are known to have the property of lowering the freezing point of liquids. The purpose of lowering the freezing point of the refrigerating medium is to enable the product to be frozen without actual freezing, i. e., solidification of the refrigerating medium. For example, sugar syrup lowers the freezing point from about 32° F. to 15° F. It is due to this temperature difference that I am able to freeze fruits, etc. whose freezing point is within the range of 29° F. to 31° F.

The amount of the material added to lower the freezing point will vary for different fruits and vegetables, and therefore the amounts of the sugar, alcohol, glycerine, etc. to be added to the refrigerating medium should be determined separately according to the specific product being frozen. As an illustrative example, when freezing strawberries with refrigerated strawberry juice, I use approximately 50% sugar and 50% fruit juice, by weight. This amount or proportion is so regulated as to obtain the lowest possible temperature for the refrigerating medium without freezing it solid.

In the case of certain fruits and vegetables, it will no doubt be impractical to prepare a juice extract as the refrigerating medium, and in such cases I propose to use a liquid or mixture of liquids which has the greatest resemblance possible to the natural juice; in other words, to approach as nearly as possible the characteristics of the juice contained in the product being frozen.

As a specific example of an application of my invention using fruit juices as a refrigerating medium, I may use the excess of the juice normally obtained from pineapple and by adding one of the above mentioned substances for lowering the freezing point of the juice I apply this refrigerating medium, at a temperature substantially below the natural freezing point, directly to the slices of the fresh pineapple. According to this example, as well as various other modifications of my process, there will result an equilibrium between the juices contained in the fruit and juices used as the refrigerating medium. In other words, no osmosis action, i. e., filtration of the fruit juices in or out of the fruit, will take place, since the osmotic pressure of the fruit juice within the product and the refrigerating fruit juice on the surface of the product is equal. This is true, of course, only when the juice in the product and the refrigerating juice are the same. Because of this equilibrium condition, the original juice in the fruit will not be extracted by the refrigerating medium as is done when certain other types of refrigerating media are employed, such as dry sugar.

One of the practical merits of my process is that it provides for using the excess of the juice always available in production, and instead of extracting any of the natural juices in the product it actually increases the amount of such juices.

While it is to be understood that the process of my invention may be carried out with various forms of apparatus, reference is made to the accompanying drawing as illustrating one convenient form of the equipment that may be satisfactorily used for freezing of fruits, vegetables, etc. in accordance with my invention. Referring now to this drawing, the equipment is shown to consist of primarily a container 1, which may assume any convenient form and which is preferably closed at the top and bottom and on all sides by insulated walls 2. This container is provided with a series of refrigerated pipes 3, having an inlet 3a and an outlet 3b, for maintaining a low temperature in the container. There is also provided a series of pipes 4 having nozzles 5 through which the refrigerating medium, whether it be a sugar syrup, fruit juice or the like, is sprayed upon the fruit, vegetable, or other product to be frozen. The pipes 4 and nozzles 5 are supplied through pipe 6 with the refrigerating medium contained in a storage tank 6. A force pump 7 is provided for forcing the refrigerating medium from the storage tank 6a through the pipes 4 and nozzles 5.

The product to be refrigerated is placed at any convenient location in the container so that it is more or less surrounded by the spraying nozzles 5 and will be thoroughly covered by the refrigerating medium emitted from these nozzles. Preferably the product should be positioned in such a manner as to permit free drainage of the refrigerating liquid.

The container 1 has a slanting floor 8, a perforated plate 9, and a receptacle 10 so as to provide a flow of the excess or waste refrigerating medium from the container through pipe 11 and thence through the force pump 7 by means of which this refrigerating liquid is recirculated throughout the system as above described.

Instead of spraying the product to be frozen, it may, of course, be dipped, brushed, or otherwise covered with the refrigerating liquid provided the latter completely covers the product and thereby prevents it from any deterioration as long as it is desired to maintain the product in a frozen condition. In the usual case the frozen product is only partially impregnated with the refrigerating liquid, although with certain products such as cherries from which the stones have been removed the refrigerating liquid penetrates the broken skin and substantially complete impregnation results.

The word "sugars" as used in the specification and claims herein is intended to cover any and all types of sugars commonly known as "sweet carbohydrates". These include, for example, cane sugar, maple sugar, glucose, fructose, lactose, maltose, etc.

It is to be understood that my invention is not limited to the specific products, treating materials, and apparatus described hereinabove, but is susceptible to various modifications and changes. The appended claims are intended to cover some of the principal novel features of the frozen product and its process of manufacture.

What I claim is:

1. A method for refrigerating edible products comprising spraying the products in their natural state with a refrigerated solution consisting of sugar and juice of said product that freezes the product without affecting adversely any of the natural properties of said product.

2. A method of refrigerating edible products comprising spraying the products in their natural state with a refrigerated liquid consisting of the juice of said product and a freezing point depressant normally present in the juices, said liquid effecting freezing of the product without affecting adversely any of the natural properties of said product.

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Exhibit #10 (j)

Patented July 4, 1939

2,164,362

UNITED STATES PATENT OFFICE

FILED
JUN 17 1944
CHARLES E. STEWART, Clerk

2,164,362

FREEZING FOODS

Robert B. Taylor, near Knoxville, Tenn.

No Drawing. Application July 7, 1938,
Serial No. 217,971

14 Claims. (Cl. 99—193)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention herein described may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to a process for the freezing and preserving of foods and is particularly directed to a new method for the rapid freezing of foods at temperatures higher than their optimum storage temperature.

A principal object of the invention is to provide a method for the freezing of foods for preservation with a minimum amount of deterioration.

A further object of the invention is the provision of a method for the rapid freezing of foods at a relatively high temperature.

Broadly, the invention comprises freezing foods, including fruits, vegetables and meats, by subjecting the foods to direct contact with a liquid refrigerant maintained at a temperature substantially below the freezing point of the food and above its optimum temperature of storage while circulating the solution over the food at such a rate that the temperature of the liquid adjacent the food remains below the freezing point of the food.

It has been found that, in general, a temperature of 0° F. is the most satisfactory temperature for the storage of frozen foods, as lower temperatures tend to have a deleterious effect on the cells of the food, while at higher temperatures degenerative changes due to oxygen and moisture, and particularly to enzyme activity, are not sufficiently avoided.

It has been found that the subjection of foods to temperatures below 0° F. even for short periods of time appears to have a destructive effect on the tissues and for this reason, in the method of the invention, the food is not subjected at any time to temperatures below its safe storage temperature, and more particularly, not substantially below 0° F.

There is a definite temperature, apparently dependent in large part on the composition of food juices, above which any particular food will not freeze. This temperature for strawberries, for example, is about 13° F. and may be called the freezing point of the food. The freezing point of various foods, such as fruit, vegetables and meats, varies to some extent, but in general, foods rapidly freeze at temperatures of 10° F. or below.

The invention, therefore, contemplates the freezing of foods at temperatures between 0° and 10° F. It has been found that at these temperatures the foods become completely frozen very rapidly if they are subjected to direct contact with a liquid refrigerant which is circulated at such a rate that the temperature adjacent the food being frozen is maintained substantially below the freezing point of the food. In general, the time for complete freezing in the process of the invention will be from two to ten minutes depending on the character of the food, the size of the units or portions and the temperature of the refrigerant liquid.

The term "completely frozen" is intended to denote that the food is frozen throughout, this does not mean that all the solutions contained in food and the water of constitution of the protoplasm are frozen, since it has been found that such components of the food may not be completely solidified until the temperature has been reduced to the neighborhood of −100° F. In a practical sense, however, foods contacted with circulating liquid refrigerants maintained at temperatures between 0° and 10° F., in accordance with the present invention are frozen throughout in a period of a few minutes and may be thereafter preserved by maintaining at a temperature of approximately 0° F. for a long period of time. It is, of course, preferable to store the frozen food in enclosed containers, since even at this temperature there may be slight deterioration due to circulation of an oxygen-containing atmosphere.

The refrigerant liquid should be suitable for use in direct contact with the food which is being frozen. It should have a freezing point of 5° F. or below and should have relatively low viscosities at 0° to 10° F. Aqueous solutions of invert sugar are particularly advantageous for use in the invention. The viscosities and freezing points of invert sugar solutions may be lowered by removing a portion of the dextrose, for example, by crystallizing out some of the dextrose, and the term "invert sugar" is intended to include such solutions containing a greater proportion of levulose than that contained in normal invert sugar. Such solutions may be prepared with freezing points substantially below 0° F. and with viscosities of less than 1000 centipoises at 0° to 10° F. Such solutions of invert sugar may, in general, be used with advantage for the freezing of all types of foods, including fruits, vegetables, and meats. Aqueous solutions of salts, particularly sodium chloride, may also be used, especially for the freezing of vegetables and meats.

The viscosity of the solution at temperatures

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between 0° and 10° F. is an important factor in the successful operation of the invention. The greater the viscosity, the thicker will be the inert layer of liquid at the interface of the liquid and food through which the heat content of the food must be transferred. Moreover, the internal heat generated in the freezing liquid itself by the work of agitating or circulating it increases very rapidly with increasing viscosity and this fact renders it impossible effectively to compensate for increased viscosity by increasing the rate of circulation. It is therefore desirable that the refrigerant solution used be one which does not exceed 1500 centipoises in viscosity at 5° F.

This invention contemplates the freezing and preservation of foods which have already been prepared in condition for final use. For example strawberries, blackberries, raspberries, youngberries, and similar types of fruits, are graded, stemmed and washed and in suitable condition for direct consumption, immediately prior to the freezing. Fruits, such as peaches, apricots, apples, plums, and the like, are peeled and pitted and prepared in final portions ready for consumption either in halves, or smaller pieces. Meats, such as chops, steaks, fowl, and fish are prepared in cuts of proper shape for final cooking, immediately prior to the freezing. In order to obtain a satisfactory rate of freezing, it is desirable that the units or portions of the foods being frozen have at least one dimension not exceeding about ¾ to 1 inch.

The following examples are illustrative of methods of operation embodying the principles of the invention:

(1) Whole, suitably prepared, fresh strawberries were immersed in an aqueous solution of invert sugar in an insulated chamber. The solution contained 57% by weight of invert sugar and had a freezing point of 0° F. and a viscosity of approximately 400 centipoises at 8° F. The temperature of the solution was maintained at about 5° F. by means of a suitable refrigerating device and the solution was circulating in direct contact with the strawberries at such a rate that the drop in temperature of the solution in passing over the strawberries was less than 1° F. The strawberries were completely frozen in 5 to 6 minutes. The frozen strawberries were then removed from the invert sugar solution, drained or centrifuged, placed in suitable containers and stored at 0° F.

(2) Fresh peas were frozen in an aqueous sodium chloride solution containing about 22% of sodium chloride and having a freezing point of about −5° F., under the same conditions and with the same procedure as in the preceding example. The peas were completely frozen in 2 to 3 minutes.

It will be seen that the invention provides a method by which foods may be frozen at temperatures above the temperature at which they may be safely stored and that by carrying out the freezing by directly contacting the food with a suitable rapidly circulated liquid maintained at a temperature above the optimum temperature and substantially below the freezing temperature of the food, in general, from 0° to 10° F., the food is frozen at such a rapid rate that crystals formed in the freezing process are so small that substantially no deterioration of the food takes place during freezing, in storage, or on thawing. The layer of refrigerant solution coating the frozen food substantially eliminates the action of atmospheric oxygen on the food during storage.

Because of the fact that in the process of the invention the foods are frozen in individual unit operations, the frozen units may be packed for storage in any desired manner for retailing, wholesaling, or storage. For example, they may be packed in one-pound containers or in barrels and in either case the food will be maintained uniform in quality and condition throughout the package. Since the food is in individual frozen units, it may be thawed out for use in any desired amounts without disturbing the remainder of the package.

This application is a continuation-in-part of my application Serial No. 91,442, filed July 18, 1936.

I claim:

1. Process of freezing and preserving a fruit, which comprises maintaining at a temperature of 0° to 10° F. an aqueous invert sugar solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F., immersing the fruit in a body of said solution, circulating the solution in direct contact with the fruit at such a rate that the fruit is quickly frozen with the formation of only small crystals therein, removing the frozen fruit from the solution, separating substantially all of the solution from the fruit, and storing the frozen fruit in containers maintained at approximately 0° F.

2. Process of freezing a fruit for preservation thereof, which comprises maintaining at a temperature of 0° to 10° F. an aqueous invert sugar solution, which has a freezing point not higher than 5° F., and low viscosities at 0° to 10° F., immersing the fruit in a body of said solution, circulating the solution in direct contact with the fruit at such a rate that the fruit is quickly frozen with the formation of only small crystals therein, removing the frozen fruit from the solution and separating substantially all of the solution from the fruit.

3. Process of freezing and preserving a food, which comprises maintaining at a temperature of 0° to 10° F. an aqueous invert sugar solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F., immersing the food in a body of said solution, circulating the solution in direct contact with the food at such a rate that the food is quickly frozen with the formation of only smally crystals therein, removing the frozen food from the solution, separating substantially all of the solution from the food, and storing the frozen food in containers maintained at approximately 0° F.

4. Process of freezing a food for preservation thereof, which comprises maintaining at a temperature of 0° to 10° F. an aqueous invert sugar solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F., immersing the food in a body of said solution, circulating the solution in direct contact with the food at such a rate that the food is quickly frozen with the formation of only small crystals therein, removing the food from the solution when frozen and separating substantially all of the solution from the food.

5. Process of freezing and preserving a fruit, which comprises maintaining at a temperature of 0° to 10° F. an aqueous invert sugar solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F., immersing the fruit which has been prepared for freezing in units having at least one dimension which does

not exceed about 1 inch in a body of said solution, circulating the solution in direct contact with the fruit at such a rate that the fruit is frozen in a period of time of the order of five minutes, removing the frozen fruit from the solution, separating substantially all of the solution from the fruit, and storing the frozen fruit in containers maintained at approximately 0° F.

6. Process of freezing a fruit for preservation thereof, which comprises maintaining at a temperature of 0° to 10° F. an aqueous invert sugar solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F., immersing the fruit which has been prepared for freezing in units having at least one dimension which does not exceed about 1 inch in a body of said solution, circulating the solution in direct contact with the fruit at such a rate that the fruit is frozen in a period of time of the order of five minutes, removing the frozen fruit from the solution, and separating substantially all of the solution from the fruit.

7. Process of freezing and preserving a food, which comprises maintaining at a temperature of 0° to 10° F. an aqueous invert sugar solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F., immersing the food which has been prepared for freezing in units having at least one dimension which does not exceed about 1 inch in a body of said solution, circulating the solution in direct contact with the food at such a rate that the feed is frozen in a period of time of the order of five minutes, removing the frozen food from the solution, separating substantially all of the solution from the food, and storing the frozen food in containers maintained at approximately 0° F.

8. Process of freezing a food for preservation thereof, which comprises maintaining at a temperature of 0° to 10° F. an aqueous invert sugar solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F., immersing the food which has been prepared for freezing in units having at least one dimension which does not exceed about 1 inch in a body of said solution, circulating the solution in direct contact with the food at such a rate that the food is frozen in a period of time of the order of five minutes, removing the food from the solution when frozen, and separating substantially all of the solution from the food.

9. Process of freezing a food for preservation thereof, which comprises directly contacting the food with an aqueous invert sugar solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F., maintaining the temperature of said solution between the temperature at which the food may be safely stored and a temperature substantially below the freezing point of the food, and circulating the solution over the food at such a rate that the temperature of the solution adjacent the food remains below the freezing point of the food.

10. Process of freezing a food for preservation thereof, which comprises directly contacting the food in the form of units having at least one dimension which does not exceed about 1 inch, with an aqueous solution which has a freezing point not higher than 5° F., and low viscosities at 0° to 10° F. and which is suitable for use in direct contact with the food, maintaining the temperature of said solution between the temperature at which the food may be safely stored and a temperature substantially below the freezing point of the food and circulating the solution over the food at such a rate that the temperature of the solution adjacent the food remains below the freezing point of the food, the food not being cooled during the freezing operation below the temperature at which the food may be safely stored.

11. Process of freezing a food for preservation thereof, which comprises directly contacting the food in the form of units having at least one dimension which does not exceed about 1 inch, with an aqueous solution which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F. and which is suitable for use in direct contact with the food, maintaining the temperature of said solution between 0° and 10° F., and circulating the solution over the food at such a rate that the temperature of the solution adjacent the food remains below the freezing point of the food, the food not being cooled below 0° F. during the freezing operation.

12. Process of freezing a food for preservation thereof, which comprises maintaining at a temperature of 0° to 10° F. an aqueous solution, which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F. and which is suitable for use in direct contact with the food, immersing the food, which has been prepared for freezing in units of the size in which it is subsequently to be consumed or cooked and consumed, in a body of said solution, and circulating the solution in direct contact with the food at such a rate that the food is frozen with the formation of only small crystals within the food, the food not being cooled below 0° F. during the freezing operation.

13. Process of freezing a food of the class consisting of fruits and vegetables for preservation thereof, which comprises directly contacting the food in the form of units having at least one dimension which does not exceed about 1 inch, with an aqueous solution which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F. and which is suitable for use in direct contact with the food, maintaining the temperature of said solution between the temperature at which the food may be safely stored and a temperature substantially below the freezing point of the food and circulating the solution over the food at such a rate that the temperature of the solution adjacent the food remains below the freezing point of the food, the food not being cooled during the freezing operation below the temperature at which the food may be safely stored.

14. Process of freezing a food of the class consisting of fruits and vegetables for preservation thereof, which comprises directly contacting the food in the form of units having a least one dimension which does not exceed about 1 inch, with an aqueous solution which has a freezing point not higher than 5° F. and low viscosities at 0° to 10° F. and which is suitable for use in direct contact with the food, maintaining the temperature of said solution between 0° and 10° F., and circulating the solution over the food at such a rate that the temperature of the solution adjacent the food remains below the freezing point of the food, the food not being cooled below 0° F. during the freezing operation.

ROBERT B. TAYLOR.

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4.

CERTIFICATE OF CORRECTION.

Patent No. 2,164,362. July 4, 1939.

ROBERT B. TAYLOR.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 52, claim 3, for "smally" read small; page 3, first column, line 32, claim 7, for the word "feed" read food; same page, second column, line 59, claim 14, for "a" read at; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of August, A. D. 1939.

Leslie Frazer

(Seal) Acting Commissioner of Patents.

FILED
JUN 17 1944
CHARLES E. STEWART, Clerk

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CLERK

BRIEF FOR APPELLEE

United States Court of Appeals

DISTRICT OF COLUMBIA

APPEAL NO. 8819

HARRY A. NOYES, APPELLANT

v.

CONWAY P. COE, COMMISSIONER OF PATENTS, APPELLEE

APPEAL FROM THE JUDGMENT OF THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

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United States Court of Appeals

DISTRICT OF COLUMBIA

APPEAL No. 8819

HARRY A. NOYES, APPELLANT

v.

CONWAY P. COE, COMMISSIONER OF PATENTS, APPELLEE

APPEAL FROM THE JUDGMENT OF THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

BRIEF FOR THE COMMISSIONER OF PATENTS

INTRODUCTION

This is an appeal from the judgment of the District Court of the United States for the District of Columbia (14)[1] dismissing the complaint in an action under R. S. 4915 (U. S. C., title 35, sec. 63) in which the appellant sought to have the court authorize the allowance of a number of claims of his application No. 304,954 for patent on methods of freezing foods. In the appellant's brief, page 2, the appeal is withdrawn except as to claims 25, 26, and 27. The ground on which the claims have been refused is lack of invention over the prior art.

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[1] The numbers in parentheses refer to pages of appellant's appendix.

APPELLANT'S APPLICATION

The application here involved (57) relates to the freezing of foods by bringing them into contact with a circulating liquid refrigerant, such as water containing salt, sugar or fruit juices. The refrigerant is cooled to the desired temperature and passes over the food in the form of a heavy spray, after which it is returned to the cooler and this process is continued as a circulation until the food is frozen.

THE TAYLOR PATENT

The patent to Taylor No. 2,164,362 (103) discloses a process of freezing foods by placing them in a bath of refrigerant, whose temperature is maintained substantially constant by circulating the refrigerant between the bath and a cooling means.

THE ZAROTSCHENZEFF PATENT

The patent to Zarotschenzeff No. 2,140,043 (101) discloses the freezing of foods by a circulating liquid refrigerant which passes over the food in the form of a spray.

THE CLAIMS

The appealed claims appear on pages 5, 6, and 7 of appellant's appendix.

SUMMARY OF ARGUMENT

1. It is immaterial whether the refrigerant contacts the food in the form of spray or a bath.
2. The exact viscosity of the refrigerant is merely a matter of choice and experimental selection.

3. The exact temperature of the cooling fluid in its passage over the food is a matter of choice.

ARGUMENT

The principal patent relied on in the rejection of the claims is Taylor No. 2,164,362. The process disclosed by this patent is basically the same as that disclosed by the appellant and recited in the appealed claims. The following specific differences exist between the process of claim 25 and that disclosed by Taylor: (1) The claim calls for a spray of refrigerant while Taylor uses a bath. (2) The claim specifies a viscosity of not over 65 centipoises while Taylor does not expressly specify a viscosity below this amount and (3) The claim states that the refrigerant has a temperature "not over approximately two degrees" above its freezing point during its passage over the food.

The remaining features of the claim are clearly disclosed by Taylor. The patent states that the freezing temperature may be "from 0 to 10°" (page 2, column 1, line 69 of patent). The 10° limit of this range satisfies the requirement of the claim that the temperature be "within the temperature range from approximately plus ten to approximately plus twenty degrees Fahrenheit." The requirement of the claim that the refrigerant temperature shall not rise more than 2° during the passage over the food is satisfied by the statement in the patent (page 2, column 1, line 42, et seq.) that the solution temperature varies by less than 1° in passing over the food. The patent refers to this variation as a "drop" but this is obviously an oversight since the refrigerant will necessarily be warmer after its contact with the food than before.

It is submitted that the distinctions above noted between Taylor's process and that claimed here involve merely matters of choice or degree which are well within the province of the skilled worker in the art and that, so far as the claims are concerned, the appellant has done no more than select what he considers suitable values from ranges contemplated by Taylor.

The equivalence of a spray and a bath as a means for bringing a liquid into contact with a solid is thought to be so well recognized as to render extensive discussion unnecessary. The ordinary shower and tub baths afford one example of this, while the various dip and spray methods of coating articles provide another. Further, the Zarotschenzeff patent presents an example of the use of a spray in the identical art here involved, namely, the freezing of foods by contact with a liquid refrigerant, specifically, a sugar solution. It seems clear, therefore, that the lower court's eighth finding of fact, to the effect that there would be no invention in using a spray instead of a bath in the Taylor process, was correct.

Sprays and baths are so common that their characteristics and the advantages and disadvantages of each are well understood and the skilled worker in any art makes his selection accordingly. The appellant derives no new or unexpected result from the use of a spray. In fact, his spray is heavy, since he states that a fog spray is inadequate, and that the liquid is "sprayed or poured" which clearly suggests a thorough drenching which would not differ greatly from the rapidly circulating bath of Taylor. The refrigerant, in the Taylor process warms up to the same or a lesser extent in contacting the food as in the appellant's process and must, therefore, pass over the food at a speed equal to or greater than that of appellant's spray or pouring. In each case the liquid thoroughly coats the food and the freezing action, therefore, should be the same.

It is suggested in the appellant's brief that Taylor's refrigerant is too sticky to be sprayed. The basis for this suggestion is not clear. Obviously any liquid which can be circulated through a bath can be sprayed if the spray openings and pressure are properly adjusted. Further, if the liquid were found to be too viscous it would be obvious to render it less so. Zarotschenzeff discloses a sugar solution for freezing foods at approximately the temperature claimed here, and being capable of free spraying. It is accordingly thought that the idea of circulating Taylor's refrigerant over the food in the form of a spray instead of a bath would not be a matter of invention.

The exact viscosity of the refrigerant is clearly a matter of experimental selection rather than of invention. Other things being equal, it would, of course, be desirable to have the viscosity as low as possible to facilitate free movement through the circulating system. On the other hand, the freezing point of a solution of sugar, salt, or similar material becomes lower as the amount of solid in solution is increased, and such increase, of course, increases the viscosity. It follows that, to obtain a lower freezing point, with a solution of any given material it is necessary to increase the viscosity. The refrigerant selected will, therefore, represent a compromise between freezing point and viscosity, and it is evident that individual opinions as to the proper values for any given food may differ, and also that the values may differ for different foods. Some persons may prefer to encounter the disadvantages of relatively high viscosity in order to obtain the advantage of a low freezing point refrigerant, while others prefer the reverse. It can scarely be said, however, that the selection of some particular values in this range requires the exercise of inventive genius.

It should be noted that Taylor, on page 1, column 2, line 33 et seq. of his patent states that the viscosity should be relatively low and explains how it may be lowered. It is evident, therefore, that the viscosity may, if desired, be lowered to the point claimed here. Taylor did not consider it necessary to lower it so far, but this is merely a matter of opinion. If Taylor's process were applied to a spray system, where lower viscosity is desirable, it would be obvious to lower the viscosity in accordance with the principles set forth by him.

The appellant's application contains no statement that a viscosity of 65 is critical. On the contrary (66) it is merely stated that appellant's viscosities are "less than approximately seventy centipoises," that "I use, as a rule, solutions falling between about forty and sixty centipoises" and that "It is evident that the flow of the higher (above my limit) viscosity solutions on the surfaces of the comestibles is not enough and the expenses of pumping and distributing such solutions are higher.'' This language clearly does not imply any critical point, but merely a gradual change and an empirical selection of a point at which flow and pumping expense conform to what are considered proper standards. The further statement in the application (66) that ''Consideration, both as to freezing the comestibles and handling the freezing solutions, have led to establishing a preference for those mixtures which have the lower viscosities and yet produce the required freezing point of water depression'' affords another clear indication that no particular viscosity is critical. If a matter is critical it does much more than to ''lead to the establishing of a preference.''

The testimony of the appellant does not establish that the claimed viscosity limit of 65 centipoises is critical. Thus he states (23) that if the viscosity is above 65 ''I do not get the character of quick freezing that this process gives.'' He does not state, however, what the difference is, nor that it is critical or even important. Obviously any material change in viscosity might be expected to produce some change in the character of freezing.

On the other hand, the testimony, taken with the specification of the application, clearly indicates that a viscosity of 65 centipoises or less is not critical. Thus the appellant testified (24) that ''I have never been able to get a sugar solution with comestible extracts but what had above 65 centipoises below approximately 10 degrees"; yet in example 2 of his invention (73) he discloses the use of a sugar solution at a temperature of "from a low plus 7 degrees F. to plus 10 degrees F." It will be evident that, if the testimony just noted is accurate, this solution must have had a viscosity above 65 centipoises, but the application nevertheless cites the use of this solution as a "specific example of freezing according to my invention." It is not clear how this situation can be reconciled with the present contention that a viscosity of 65 is critical.

On cross examination (50–53) the appellant apparently sought to repudiate the example just considered. However, this example is as much a part of the teaching of the application as anything else and it cannot properly be ignored in order to make the disclosure of the application appear to be further removed from the prior art. Since the application, as a whole, does not teach that a viscosity of 65 is critical, but rather the reverse, the subsequent discovery of the alleged criticality cannot be relied on to support the allowance of claims (*Abbott* v. *Coe,* 71 App. D. C. 195, 109 F. (2d) 449).

It is submitted that a holding of patentability cannot properly be predicated on the specific viscosity set forth in the claims, but that this represents merely a choice which is, and should remain open to any worker in the art.

The third alleged distinction of the claims over the Taylor patent is the statement that the refrigerant is applied at a temperature "not over approximately two degrees Fahrenheit" above its freezing point.

This is also a matter of choice and experimental selection, as is clearly suggested by the fact that the temperature specified is approximate only. Taylor, on page 2 of his patent, line 37 et seq. gives an example of freezing in which the refrigerant has a freezing point of zero degrees Fahrenheit and is applied to the food at a temperature of five—difference of five degrees as compared with the "approximately two" of the claims. This difference is clearly without patentable significance.

There is no apparent reason why a temperature of two degrees above the freezing point should have any particular advantage over three, four or five degrees and there is certainly no suggestion of any such critical difference in the appellant's specification. On the contrary, he repeatedly gives examples of his alleged invention in which temperatures of more than two degreees above the freezing point are used. Thus (73) in example 2, the temperature of the refrigerant is said to range from 7 to 10 degrees F. Even the lower point of seven must be slightly above the freezing point, since the refrigerant does not solidify, and the upper limit of ten is thus more than three degrees above the freezing point. Again (74) reference is made to a range of 10 degrees F. to 14 degrees F., which means that the refrigerant reaches a temperature more than four degrees above its freezing point and in example 3 (74) appellant describes the use of a refrigerant which freezes at 11 degrees F. and is used in a temperature range of from 12 to 14 degrees F—the upper limit being thus three degrees above the freezing point.

It seems evident that there is no patentable difference between these various examples of the appellant's process, in which the refrigerant rises at least four degrees above its freezing point, and that of Taylor in which it rises five. Clearly the term "approximately two degrees" must be broadly construed, in view of the appellant's specification and, as thus construed, it presents no material distinction over Taylor. The exact temperature to be used is a matter to be selected experimentally and such selection does not require the exercise of invention.

The appellant advances a theory as to a particular method of freezing, involving the formation of a shell of ice, which is alleged to take place in his process. There is no apparent reason why the same result should not be obtained by Taylor. The appellant's application gives a number of different examples in which this result, presumably, is obtained and the Taylor process does not seem to differ more from some of these examples than they differ from each other. Obviously, there will not be a hair-line change between conditions which will form a shell of ice and those which will not. The shell would gradually become thinner and then incomplete and would finally disappear. Clearly, if appellant can obtain a satisfactory shell with a refrigerant four degrees above its freezing point, Taylor must obtain some sort of shell at five degrees above. The difference clearly is not one of kind but of degree only and is thus within the field of experimental determination and selection.

For the reasons above given, claim 25 fails to present anything patentable over Taylor. Claims 26 and 27 differ from claim 25 only by reciting the refrigerant more specifically. Claim 27 states that it is "a solution of sugar and comestible constituents," while claim 26 recites it as a sodium chloride solution. Taylor, on page 2, column 1, discloses the use of a sugar solution in example 1 and a sodium chloride solution in example 2. Claims 26 and 27, therefore, are met by Taylor in exactly the same manner as claim 25.

It is submitted that the appellant has merely modified the Taylor process by the experimental selection of slightly different values of viscosity and temperature which are in no way critical and which have not been shown to produce any unexpectedly superior result. Assuming that appellant's process is somewhat superior to that of Taylor, this is not enough to warrant the grant of a patent since the superiority is the result of routine experimentation only. As was said by this Court in *Minnesota Mining and Manufacturing Company* v. *Coe,* 69 App. D. C. 217, 99 F. (2d) 986:

> "But a showing of great industry in experimental research is not in itself sufficient to constitute invention, when the product thereof differs from those of the prior art only in degree and the result—no matter how useful it may be—is merely one step forward in a gradual process of experimentation."

Similarly in *Naamlooze Venootschafs* v. *Coe,* 76 U. S. App. D. C. 313, 132 F. (2d) 573, the Court said: "it does not follow that every new and useful result accomplished by experiment is patentable."

Another case in point is *Allen, et al.* v. *Coe,* 135 F. (2d) 11, 77 U. S. App. D. C. 324 which, like the present one, involved a compromise in proportioning. That case involved the use of grain mash in the production of yeast. It was found experimentally that a large amount of grain mash increased the vitamin content of the yeast but reduced the yield. The appellants claimed the use of an amount of mash different from that of the prior art. In holding that this was lacking in invention the Court said:

> The problem was to use an amount which would give the required vitamin content without unduly decreasing the yield. The solution of this problem was a mere matter of experiment involving nothing more than the skill of a laboratory technician. This is not invention within any proper meaning of that term.

CONCLUSION

It is submitted that the present case involves nothing more than the experimental selection of certain values in accordance with the principles well understood in the art and without the production of any unexpected result. The holding of lack of invention, by the lower court, and the Patent Office was therefore correct.

Respectfully submitted.

W. W. COCHRAN,
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E. L. REYNOLDS,
Of Counsel.

NOVEMBER 1944.

U. S. GOVERNMENT PRINTING OFFICE: 1944

In the

UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA.

October Term, 1944.

No. 8819.

Harry A. Noyes,
Appellant,

v.

Conway P. Coe, Commissioner of Patents,
Appellee.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA.

REPLY BRIEF FOR APPELLANT.

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for the District of Columbia
ED [illegible] 1945
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HARRY A. NOYES,
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CONWAY P. COE, Commissioner of Patents,
APPELLEE.

Appeal from the District Court of the United States
for the District of Columbia.

REPLY BRIEF FOR APPELLANT.

Preliminary Statement.

After studying appellee's brief it seems desirable to reiterate what appellant claims as his invention, inasmuch as it does not lend itself to descriptive generalizations without losing its pith.

The appellant claims a method of quick freezing comestibles without cellular or chemical change by (1) applying a spray of an aqueous solution not more viscous than 65 centipoises (2) at a temperature between 10° and 20° F. and (3) not over about 2° above that temperature at which ice will form in the solution on cooling, (4) in such volume that it will be rapidly and continuously replaced on the comestible surfaces and (5) so that its temperature in its cycling is not raised over 2° in its passage from cooling means over the foods and back to the cooling means (claim 25). The aqueous solution may contain sodium chloride and comestible juices (claim 26) or sugar and comestible juices (claim 27).

The appellant utilizes a new principle—that of forming an ice coating around the food to be frozen, very early in the quick freezing operation. Ice being a better conductor than a liquid film, and the temperature employed being higher than ever before used, the process is more economical and efficient. Without the ice coating, osmosis depletes the food. With the ice coating osmotic action is prevented. The osmotic action, *i.e.,* the juice oozing from the fruit as it is first chilled, dilutes the solution so that it is proportionately weakened, and in a comparatively short time the ice crystals form on the surface of the food. The forming of the ice film from the juice at the surface of the fruit as it first comes in contact with the refrigerant solution seals the food stuff. This is the heart of the invention.

We repeat that the prior art does not disclose the invention, and that the Patent Office did not discuss it in such manner as to show that it understood it.

We submit that it is not a matter of experimental choice or trial selection, but that the underlying theory is novel and is not hinted at, much less disclosed, in the prior art.

Statement of Points.

1. The statement that it is immaterial whether the refrigerant contacts the food in the form of spray or by immersion (loosely termed "bath" by appellee) neglects the fact that with an immersion process there are limitations on the character of work that can be done as to both dimensions and results.

2. The statement that the exact temperature and viscosity of the solution in its passage over the food is a matter of choice neglects pertinent facts.

3. The clear errors in the lower tribunals require reversal.

Summary of Argument.

A. Appellee's argument that it is immaterial whether a bath (immersion) or a spray is used is unsound and immaterial because—

The immersion process of Taylor's differs from appellant's process in that Taylor's process—

(1) has an inert stagnant layer surrounding the foods which (*a*) is a great deterring factor in heat transfer; and (*b*) creates high osmotic loss;

(2) is subject to *dimensional limitations* of ¾ to 1 inch in at least one measurement;

(3) fails to disclose or utilize the advantages of applying the solution near the temperature where ice would form in the solution;

(4) does not contemplate and cannot create the ice shell of appellant's process;

(5) applies a brine solution at a temperature 10° above the temperature at which ice will form in it; this does not meet claim 26 or any other;

(6) uses a sugar solution which cannot be sprayed, and is of a composition far outside appellant's viscosity limits essential to rapid heat transfer.

B. Appellee's argument that exact viscosity and temperature are a matter of choice and experimental selection is not well founded because—

(1) Appellant is first to form a shell of ice—a revolutionary conception.

(2) The appellant's result is an undepleted product, since the ice shell prevents further osmosis.

(3) Ice is a better conductor of heat than water or comestible skin and hence aids in quick freezing.

(4) The conception of the process and the theory involved required genius, and is invention.

(5) The development of the process *after* its conception and the finding of safe ranges is the only "experimenting."

(6) Appellee's argument that the viscosities and temperatures of the solutions are not critical does not stand analysis.

(7) The prior art shows another school of thought and an entirely different approach to a freezing process—appellant is iconoclastic.

C. The errors in the prior art, in the Patent Office tribunals and in the findings of the District Court render their opinions on technical matters of no value.

The errors are as follows:

(1) *Of the prior art:*

(*a*) Taylor states "viscosities and freezing points of invert sugar solutions may be lowered by removing a portion of the dextrose . . ." (A. p. 103, col. 2, ll. 37-40).

(*b*) Taylor gives the "freezing" temperature of strawberries as "about 13° F." (A. p. 103, col. 1, l. 47).

(*c*) Zarotschenzeff states that the "natural juices of the product being frozen" may be used as the freezing agent (A. p. 101, col. 2, ll. 45-46).

(*d*) Zarotschenzeff states that by using fruit juices with sugar or other freezing point depressants he may prevent osmotic action (A. p. 102, col. 1, l. 45 *et seq.*).

(*e*) Zarotschenzeff describes a method of freezing by pumping a solution, not previously cooled, into a refrigerating enclosure, which method is inoperative on the fact of the disclosure (A. p. 102, col. 2, ll. 1-30).

(2) *Of the Examiner:*

(*a*) That Taylor and appellant use the same solutions at the same temperature (A. p. 86).

(*b*) In stating that a solution with a viscosity of 400 centipoise at 8° F. would be the same as appellant's—65 centipoises—at 10° (A. p. 86).

(*c*) In disregarding the real issue—the formation of the ice shell and in failing to discuss the 2° differential between temperature of application of solution and the temperature at which ice will form therein (A. p. 86).

(*d*) In stating that the temperature of the solution is not permitted to rise more than 3° F. (A. p. 86) when the claimed rise is 2° F.

(3) *Of the Board of Appeals:*

(*a*) In following the Examiner's errors.

(*b*) In denying that Taylor's was an immersion process (A. p. 90).

(*c*) In finding that Taylor's solution could be sprayed (A. p. 92).

(*d*) In following Taylor's error in stating that viscosity and freezing point could be lowered by removing dextrose (A. p. 90). This is not so as to the freezing point.

(*e*) In stating that freezing points and viscosity could be raised by addition of dextrose (A. p. 92). This is not so as to the freezing point.

(*f*) In following the typographical error in the Taylor patent that "the *drop* in temperature of the solution is . . . less than 1° F." (A. p. 90).

(*g*) In disregarding the critical difference of 2° in its reconsideration.

(4) The trial court followed the errors of the Patent Office tribunals.

Argument.

The appellant, of course, will attempt to avoid here arguments which are made in the "Brief for Appellant" already filed, but the viewpoint of the appellee as expressed in his brief, indicates that some points which appellant had deemed indisputable may not yet be sufficiently clear.

We had thought it was clear that immersion and spray were sufficiently distinguished and yet the appellee still persists that there is a similarity. However, the argument of similarity will not stand analysis.

A.

APPELLEE'S ARGUMENT THAT IT IS IMMATERIAL WHETHER A BATH (IMMERSION) OR A SPRAY IS USED IS UNSOUND.

(1) *The importance of the inert layer in Taylor's process.*

(*a*) *It prevents the transfer of heat.*

Taylor's process as described in his patent involves an "inert layer of liquid at the interface of the liquid and food through which the heat content of the food must be transferred" (A. p. 104, col. 1, ll. 3-6).

The importance of this layer or film cannot be minimized as it is established that such layers are of greatest importance.

In a standard work on mechanical refrigeration* it is said, referring to the thermal conductivity of metals and the differences between facts and theories—the facts indicating a great loss of conductivity in practice:

> "Evidently there is some resistance other than the resistance of the metal itself. The usual explanation is that a *film of almost stagnant liquid* is present on the surface of the metal. Water and most liquids are very poor conductors of heat. It is found, for example, that if a film of water 0.01 inches thick is on one side of a copper plate it will decrease the rate of heat transfer from 40,000 to 300 B.T.U. Evidently, then the problem in commercial work is to get heat, not through the metal wall, but through the thin films of stagnant liquids or gas."
>
> H. J. Macintire, *Handbook of Mechanical Refrigeration,* pub. by John Wiley & Sons, Inc., 1928, p. 211.

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*See appendix attached.

The court need only recall the film retained on a spoon dipped in molasses, honey or maple syrup to appreciate the thickness of sugar syrups and the thickness of films around the foods in Taylor's process.

(*b*) *The layer promotes osmotic depletion.*

Furthermore, the Taylor process with the heavy solution, highly viscous (the lowest viscosity mentioned being 400 centipoises, A. p. 104, col. 1, l. 42), is of such comparatively high sugar content that the osmotic pressure and consequent depletion is so much higher than is appellant's solution that water, being of "low molecular weight and high mobility," moves from the object to be frozen into the stagnant solution with rapidity (A. p. 46). Consequently Taylor's process produces foods depleted and changed, berries losing at least 14% of their weight, whereas the appellant's process occasions a loss of only 2% to 4% (A. p. 36).

(2) *The dimensional limitation of Taylor.*

Admittedly an immersion process is impossible without an ever present film, and the startling fact is that the film is of such great insulating power. Here alone there is enough reason to discard an immersion process as being of the same character or the same kind of process as a spray. The fact is that Taylor admittedly may operate only on foods having "at least one dimension not exceeding about ¾ to 1 inch," due to the insulating or osmotic effect caused by the stagnant layer (A. p. 104, col. 1, l. 32). This is convincing proof that the Taylor immersion process is different in essence and kind from appellant's spray process, which is capable of quick freezing whole fowls, turkeys, melons and the like (A. p. 37). (See Exh. 8, A.

p. 99, "Quick" Freezing Noyes Method on Full Grown Fowl, and testimony, A. pp. 47, 48.)

As we have previously pointed out, there is such a tremendous lag in heat transfer in the Taylor process that he erroneously fixes the freezing point of strawberries at 13° F. (A. p. 103, col. 1, l. 47), whereas the actual freezing point of strawberries is 29.9° F. (A. p. 98). The fact is that Taylor's process is so inefficient because he must thicken his solutions with enough sugars so that they remain liquid at +5° F. or lower.

(3) *The importance of temperature of application near the temperature at which ice will form in the solution.*

We pointed out in our main brief that applicant's process is based for novelty and utility on the formation of an ice shell. Such a phenomenon goes entirely untouched in the prior art (Appellant's Brief, pp. 9, 10, 11). It is so iconoclastic that the thinking in the Patent Office did not vision it at all. The trial court declined to consider a brief and evidently missed the point as well (see original transcript, p. 83).

The specification states: "When a freezing solution in the viscosity ranges of my invention is being circulated at approximately as low a temperature as possible—without forming ice—there is a tendency for ice to be formed on the surface of the comestible at first contact between the freezing solution and the comestible to be frozen" (A. p. 69).

(4) *Taylor does not contemplate an ice shell and cannot create it.*

Taylor applies his solution at temperatures so much higher than the temperature at which ice will form in the refrigerant solution that dilution by osmosis is insufficient to weaken the solution so that ice shell formation will take place on the interface or surface of the foods.

The two processes are here distinctly different.

(5) *The sodium chloride application of Taylor, compared with appellant's.*

Taylor immerses peas in a sodium chloride solution with a freezing point of —5° F. He uses the solution at a temperature of +5° F. (A. p. 104, col. 1, ll. 54-59, 42-48). No part of the solution will ever form ice on contact with the surface of the foods under these circumstances. There is a difference of 10° F. between the two temperatures, which requires tremendous dilution before ice crystals will form in the solution. Appellant claims a difference of not over approximately 2° between the temperature of application and the temperature at which ice will form in the solution. Here is no similarity in the two processes, but another striking difference.

(6) *Taylor's sugar solution cannot be sprayed and flows too slowly to be used in appellant's process.*

We have previously pointed out that there is no suggestion anywhere that Taylor's solution can be sprayed and that there is ample testimony that a 57% invert sugar solution is too viscous to be sprayed. The rapid flow necessary in appellant's process is also lacking. ". . . in spraying strawberries even with high pressures the 57% solution just doesn't work in the apparatus and further than that, *that kind of viscosity fails to give the flow* on the surface on the food stuff that is required to carry out my quick freezing" (A. p. 39). (Italics supplied.)

The suggestion that Taylor's solution can be sprayed or that immersion is equivalent to a spray just is not so, yet all the lower tribunals have assumed that possibility (A. pp. 14, 86, 89, 92).

We have previously shown that Taylor's solution cannot be sprayed, that it is too viscous, that its freezing point or point where ice will form is too far below the temperature of application to constitute a revelation or suggestion of appellant's process (Appellant's Brief, pp. 14-15).

B.

APPELLEE'S ARGUMENT THAT EXACT TEMPERATURE AND VISCOSITY ARE MERE MATTERS OF CHOICE AND EXPERIMENTATION IS NOT WELL FOUNDED.

(1) *Applicant is first to form a shell of ice.*

We need not here add to the appellant's brief any further argument on the formation of the shell of ice, the prevention of osmosis by using its result—the exuded extracts. We submit that the conception of preventing osmosis by forming an ice shell was the inventive act in this case, and that the experimenting to discover solutions that would have free enough flow (low viscosity) to attain the result at a temperature that gave quick freezing was the mechanical development of the "flash of genius" in the conception.

(2, 3) As we have argued in the main brief, the shell of ice prevents osmosis, promotes heat transfer and produces a better product by a different method.

(4, 5) We submit that the inventive act was the conception of the ice shell. In such circumstances the fact that experimentation was necessary to establish safe ranges in the solutions, temperatures and volume of application is purely secondary.

To quote Judge Hand:

> "If the thing be new, very slight structural changes may be enough to support a patent. We are to judge such devices not by the mere innovation in their form or material, but by the purpose which dictated them and discovered their function."

Traitel Marble Co. v. *Hungerford Brass Co.*, 18 Fed. (2d) 66, 68.

The Circuit Court of Appeals for the Seventh Circuit has said:

> "Invention is the idea itself, the burst of new thought, the discovery; and patentable invention is the conjunction of these with appropriate and efficient mechanical means."

Brown v. *Crane Co.*, 133 Fed. 235, 237 (C.C.A. 7).

Patent Royalties Corp. v. *Land O'Lakes Corp.*, 89 Fed. (2d) 624, 627 (C.C.A. 2).

In view of this doctrine, appellant's theory being new, the purpose and function of his conception being undisclosed in the prior art, slight changes in the known processes are enough to justify a finding of invention.

(6) *Appellee's argument that the viscosity and temperatures of the solution are not critical does not stand analysis.*

The appellee on pages 8 and 9 of his brief argues that the specification shows three freezing examples which are not, so he says, within the scope of the claims here in issue.

He points out that below 10° the viscosity is more than 65 centipoises, yet an example is given of freezing at temperatures of 7°-10° F. (A. p. 73). This example was in the specification when filed and when, like most inventors, the applicant was soliciting broad claims—claims not limited to close ranges of viscosity and temperatures and not involving the formation of the ice shell and consequent high quality of product. Appellee says that, inasmuch as foods were thus frozen, there is no definite line of demarcation, no critical point at which viscosity is too great or temperatures require close control as claimed. We do not deny that foods of limited dimensions may be frozen in a depleted condition by the application of cold solutions such as Taylor's, but we earnestly contend that the process of the claims in issue is a new principle of operation and that the steps of the claims are essential to attain the successful result. The example quoted is not within the claims and does not produce the successful results of the invention now involved.

The other examples quoted (a range of 10°-14° and the use of a refrigerant which throws off ice at 11° and is used at 12°-14°) are of course within the scope of the claims. The claims require a solution to be applied at a temperature of not more than 2° above the ice forming point (in the example quoted, at say 12°-13°) and the solution may be warmed not over 2° in its use (that is, to 14° or 15°), which permits the use of the ranges quoted. Accordingly there is an allowable range of 4° between the ice forming temperature and the temperature to which the solution may be raised in its flow from cooling means over the food and back to the cooling means.

It is common for a patent specification to describe the invention in broad terms and to suggest a variety of uses and applications, some of which may be anticipated by the prior art. If the prior art requires a narrowing of the claims and the claims then define a novel process, statements in the specifications which suggest an invention broader than the claims may be disregarded.

Statements made which are inaccurate or misleading may be rejected as surplusage.

Lombard et al. v. *Coe,* 33 Fed. Supp. 440.

To quote a decision dealing also with viscosities:

> ". . . his specifications still contain the statement that 'generally' the critical limit is as high as that . . . (16.2 second nitro cellulose). He was more acquisitive than he should have been, as inventors often are; but that ought not to take away from his invention, if he made one. The claims in suit are limited to 4.6 second viscosity, and that is what he actually found. The very purpose of the disclaimer statute is to allow retraction . . . The fact that he may have wrongly guessed that the limit was higher does not abate from the fact that he has found the actual limit, that which the art has now adopted. He could not be expected to set a definite figure; there is none, for viscosity may vary even below his limit. But he did set that limit definitely, and in a chemical patent that is all that is required. The supposed vacillation in his conception seems to us to be no more than is permissible to one who has in fact discovered a chemical invention of substance, but who is in doubt whether it may not extend beyond his experimental verification. Somewhere no doubt he must set his bounds at his peril, and that he did."

Dupont & Co. v. *Glidden Co.,* 67 Fed. (2d) 392, 395 (C.C.A. 2).

If this application is returned to the Patent Office by this court, the appellant may there have an opportunity to revise his specification and clarify his invention consistently with the decision of the court.

In fact, the appellant has gone on record as desiring to eliminate certain material as a mistake and as an example of a specialized product (A. pp. 50-54).

We submit that the examples quoted do not derogate from appellant's right to a patent on what is new.

On page 10 of the brief the appellee has made a harmless technical error in using the expression ". . . the appellant's process in which the refrigerant rises at least four degrees above its freezing point,* and that of Taylor in which it rises five." The fact is that in appellant's process the temperature must not rise over 2° and in Taylor the rise is only 1°.

(7) *Appellant is iconoclastic—he utilizes a new approach.*

We have pointed out in our main brief that the previous thought in commercial freezing involved a race between freezing and osmosis (Brief, p. 12), that lowest possible temperatures were formerly the desired means of freezing (Brief, p. 13), and consequently the results were products bled of much of their desirable character.

In appellee's brief we find only the statement that it is not apparent that a shell of ice would not form in Taylor's process and that in any event its formation is merely a matter of degree. We could answer by using the words of the Barbed Wire Patent case—referring to a simple improvement: "It may have been under their very eyes, they may also be said to have stumbled over it, but they certainly failed to see it, to estimate its value, and to bring it into notice."

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*The appellee uses the expression "freezing point" very loosely in his brief, since he does not differentiate between the temperature at which ice crystals will form and the point at which the solution is frozen. As is evident from the record, ice crystals may form in the solutions here involved, depending on the percentage of solids, all the way from 32° to the eutectic freezing point (see Exhibit 3, Refrigerating Data, Brines and Solutions).

Barbed Wire Patent, 143 U.S. 275, 283.

With the multitude of different systems of freezing and the innumerable patents relating thereto, it is a matter of wonder, if not bewilderment, that there are no suggestions anywhere of this—as it now appears—most simple solution. It is a striking tribute to the appellant's genius that the closest prior art is Taylor, who makes no suggestion of the phenomenon of the ice shell and whose process is so distinctly different, and so inadequate.

Appellant states his invention as follows: ". . . I have made conditions at the interface where the liquid hits the product such as that heat is conducted away from that product more rapidly than the interior can give it up. As a result, and the conditions of the solution, the surface has to form ice . . . you encase the outside and freeze it, and since ice is a better conductor than the unfrozen . . . rapidly moving cell by cell, layer by layer, the frozen state goes inward . . ." (A. pp. 49, 64, 69, 24, 25).

We submit, earnestly, that the case at bar exhibits inventive genius of a high order.

C.

THE ERRORS BELOW WARRANT A CONCLUSION BY THIS COURT THAT THE TRIBUNALS BELOW FAILED TO GIVE THIS CASE PROPER CONSIDERATION AND THAT THEIR OPINIONS ARE OF LITTLE VALUE.

(1) The errors in the prior art are in part discussed in our main brief (pp. 14, 18).

(*a*) The statement in the Taylor patent (A. p. 103, col. 2, ll. 38-40) that viscosities and freezing points may be lowered by removing dextrose is not an accurate statement without explanation, and the Board of Appeals in stating that by implication the viscosity and *freezing points* may be raised by adding dextrose is clearly in error (A. pp. 31, 32).

Appellee's brief states the true principle on pages 5 and 6, where it is said: ". . . the freezing point of a solution of sugar, salt,* or similar material becomes lower as the amount of solid in solution is increased, and such increase of course increases the viscosity" (Appellee's Brief, pp. 5, 6).

(*b*) Taylor's statement (A. p. 103, col. 1, l. 46) that the temperature above which strawberries will not freeze is 13° F. and "may be called the freezing point of the food" is directly contrary to the facts, in common knowledge and on the evidence (A. p. 98) (Exh. 7, pp. 18 and 33).

(*c*) Zarotschenzeff states that the "natural juices of the product being frozen" may be used as the freezing agent (A. p. 101, col. 2, ll. 45-49). Obviously the juice of a fruit has approximately the same freezing point as the fruit itself (A. p. 45).

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*It may here be noted that no great increase in viscosity is caused by increasing the concentration of sodium chloride solutions which are free flowing, though the principle stated is true (A. p. 62).

(*d*) Zarotschenzeff states that by using juices of the fruit being frozen and sugar he may prevent osmotic action (A. p. 102, col. 1, ll. 44-45). This is an error as the higher concentration of sugars in the freezing medium will draw juices from the product being frozen (A. pp. 44-46), the higher concentration of sugars drawing the water from the fruit.

(*e*) Zarotschenzeff's process is inoperative on the face of the patent.

Zarotschenzeff discloses a refrigerated enclosure into which the solution is pumped as a spray without previous cooling. Such a process would merely cause a cooling of the spray in its passage from the nozzle to the food and would have no freezing effect on the comestibles. It would inevitably warm the foods to be frozen rather than cool them. Any freezing would come from the refrigerating coils and the consequent cooling of the atmosphere in the container. It is inoperative on its face.

There is no disclosure in this patent that would point the way to the method of appellant's claim.

(2) The errors of the Examiner:

(*a, b, c*) The error of the Examiner in his statement that Taylor and the appellant use the same solutions at the same temperature is discussed in our brief (p. 19), that the viscosity of Taylor of 400 centipoises at 8° F. would be as low as 65 centipoises at 10°-20° F. (p. 20), in missing the points about the ice shell and in failing to discuss the differential between the temperature of application and the temperature at which ice will form (p. 19).

(*d*) Moreover, the Examiner erred in stating that the temperature of the solution is not permitted to rise more than 3° during its cycling, when the claims here involved call for a rise of not more than 2° (p. 86, and see claims in issue).

(3) The errors of the Board of Appeals are in part the same as the errors of the Examiner, which are repeated and approved.

However, the Board erred even more seriously in saying (*b*) that it was not apparent that Taylor mentions the immersion of materials in his refrigerant (A. p. 90).

(*d, e*) It is not easily understood how the Board of Appeals could rationally have said, as it did: "The patentee [Taylor] also discloses that the viscosities and *freezing points* of invert sugar solutions may be *lowered* by removing a portion of the dextrose which seems to indicate reversely that the viscosity and *freezing points* could be raised by the addition of dextrose" (A. p. 92). (Emphasis ours.)

Here appears a fundamental error, indicating a clear lack of understanding of all the principles involved.

(*f*) The Board followed verbatim the typographical error of Taylor (A. p. 35), who states (A. p. 104, col. 1, l. 47) that there is a drop (*sic*) in temperature of the solution in passing over the foods (A. p. 90).

(*g*) The Board erred in summarizing, on reconsideration, the appellant's claims without regard to the critical difference of 2° F. between the temperature at application and the temperature at which ice will separate as an element of importance in the process, again basing the rejection on the matter of viscosity (A. p. 92).

We submit that, if ever there was a case where the errors of the Patent Office tribunals have contributed to an erroneous decision, it is this case. We contend that the errors of the Examiner and the Board indicate a startling, if not shocking, neglect of an applicant's rights, and that the opinions expressed are such that the court is not justified in affirming them.

Errors of the District Court.

We have in our main brief pointed out (pp. 20, 21) the errors of the District Court which followed the opinions of the Patent Office, although introducing the misnomer "bath" for the immersion of the Taylor process, and will not discuss the findings further herein.

Conclusion.

We submit that the appellant has made a stepping stone to success of what was previously a stumbling block; that he has turned to advantage the greatest impediment to perfection in the art; that he has done much to perfect the art of freezing; and that his concept was clever, ingenious and inventive.

We submit he should have his patent.

Respectfully submitted,
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Appendix.

HANDBOOK
OF
MECHANICAL REFRIGERATION

BY

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NEW YORK
JOHN WILEY & SONS, INC.
London: CHAPMAN & HALL, Limited
1928

densation occurs and the liquid condensate flows from pipe to pipe into the liquid receiver. The loss of effective surface (loss in the sense of decreased heat transfer due to the layer of liquid ammonia) might be easily 50 per cent or more of the surface in the lower tubes. This trouble is even greater in the case of the drip type condenser, which has a liquid flow in many of the pipes counter to the flow of the compressed gas discharge from the compressor, and always has most of the work of the condenser performed in the upper pipe when cold condensing water is used or in the upper two or three pipes when large amounts of warm water are used.

Another disturbing factor in condensers is the presence of air. In Orrok's[7] tests on steam condensers it was found that the presence of air reduced the value of k to about $\frac{1}{5}$ of the value obtained with an air-free surface.[8] However, all commercial condensers have air present to a greater or a lesser degree, although there is more care now (1927) than

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[7] Geo. Orrok, Amer. Soc. of Mech. Eng., 1911.

[8] **The Effect of Surface Film on Heat Transfer.**—Heat transfer in ordinary cases is often confused with the thermal conductivity of the material through which the heat has to pass. For example it is said in the proceedings of an important association that, since copper is seven times as good in conductivity as iron is, replacing iron tubes with copper ones in an evaporator or heater should increase the capacity seven times. Actually it increases the capacity only about 10 per cent.

This indicates that there is some factor in heat transfer for which one must look further. If one considers a plate of copper 1 ft. square and 0.065 in. thick the usual values for the thermal conductivity of copper would indicate that there should flow through the plate, per degree F. difference of temperature on the two sides of the plate per hour, about 40,000 B.t.u. If this were an iron plate, about 6500 B.t.u. should pass through under the same conditions. In actual practice the values taken are usually from 250 to 300 B.t.u. though it is possible that the practical value may go up to as much as 1000 under unusual conditions.

Evidently there is some resistance other than the resistance of the metal itself. The usual explanation is that a *film of almost stagnant liquid* is present on the surface of the metal. Water and most liquids are very poor conductors of heat. It is found, for example, that if a film of water 0.01 in. thick is on one side of a copper plate it will decrease the rate of heat transfer from 40,000 to 300 B.t.u. Evidently then the problem in commercial work is to get heat, not through the metal wall, but through the thin films of stagnant liquids or gas. It is necessary, therefore, to know what factors affect the thickness of these films and how it is possible to predict their resistance.

Consider a tube with water on the inside and steam on the outside, and also the resistance that is offered to the flow of heat from the tube to the liquid. It is found that the greater the velocity of the liquid the thinner the stagnant film and that the greater the viscosity the thicker the film. For a film of given thickness the narrower tubes or denser liquids result in higher rates of heat transfer. These factors can be calculated numerically for a few limited cases which arise in practice. For the great bulk of practical cases it is possible to predict only in part what effect a given change in design may have.